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SCIENTIFIC AMERICAN

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August 19, 1916

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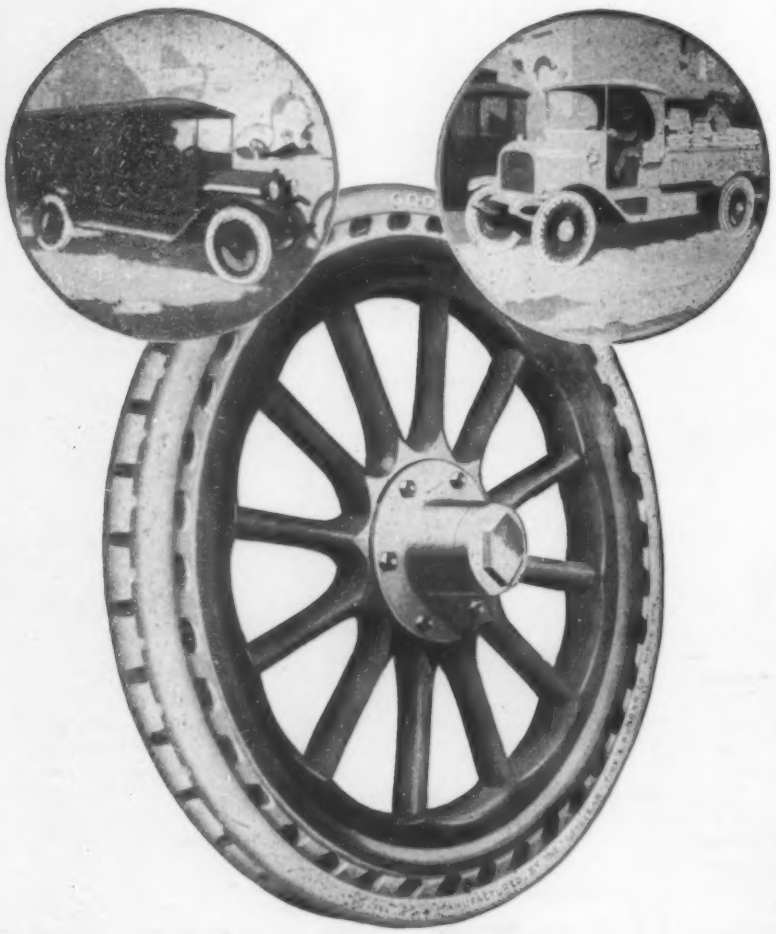

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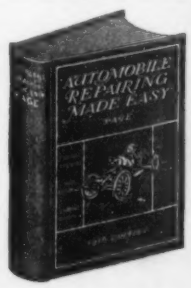

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SEVENTY-SECOND YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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A New Form of High Voltage Measuring Instrument

By J. B. Whitehead, Professor of Electrical Engineering, Johns Hopkins University

IF voltage is applied to a bare, straight, round wire and gradually raised, there comes a point when, if viewed in the dark, a glow appears close to the surface of the wire. This glow has been called the "Corona."

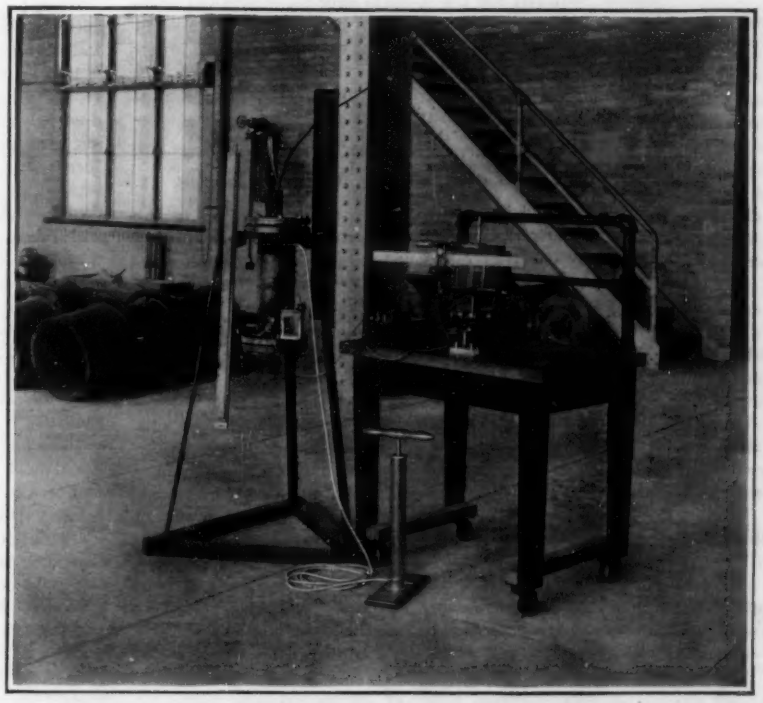
Corona was first observed about 25 years ago when the highest voltages on transmission lines were in the neighborhood of 2,500 volts. The corona is objectionable because it is a source of energy loss and it causes insulation to deteriorate.

Since the appearance of corona limits the voltage which may be used in transmission, the laws of corona formation have been extensively studied since the phenomenon was first observed. One of its most striking properties is the fact that, with a given wire, the corona appears at a very definitely marked voltage. The voltage may be repeatedly raised and lowered and corona appears at exactly the same value. The value of voltage at which corona appears depends on the size of wire, on the position and shape of the conductor forming the opposite side of the circuit, and also on the density of the air. It does not depend on the moisture content of the air. Under ordinary atmospheric conditions, corona would appear on an ordinary transmission line consisting of 2 No. 2, B. & S. bare wires, placed 2 feet apart at about 150,000 volts.

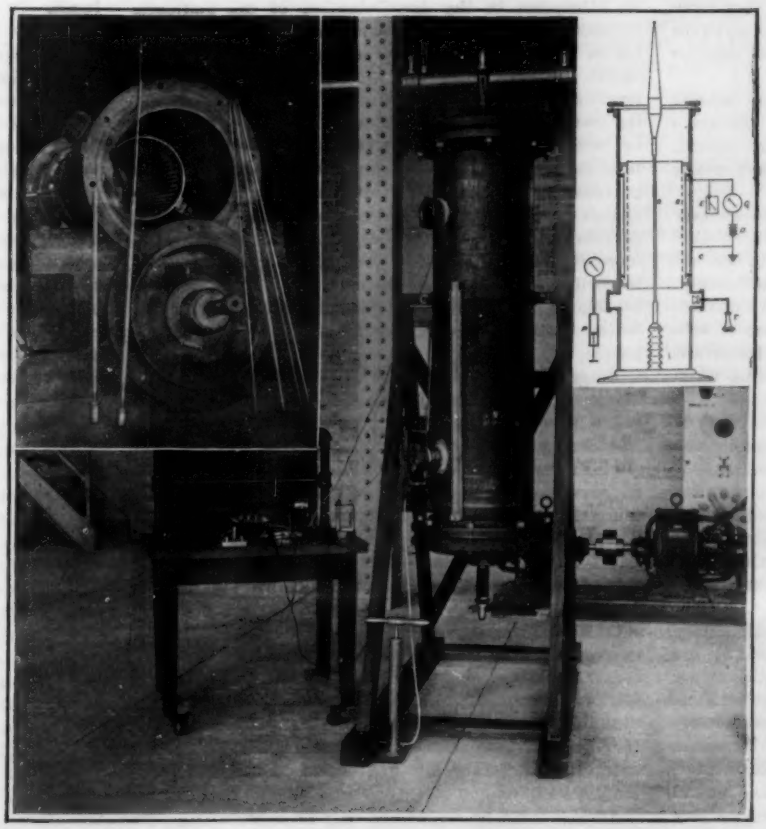
By far the best arrangement of apparatus for producing and observing the corona is an outer cylinder with a clean, straight wire stretched along its axis, the cylinder and wire forming the two terminals to which the voltage is applied. This gives a uniform electric field about the wire and one which is free from disturbance due to the neighborhood of other objects. Also, if the outer cylinder be connected to earth, the apparatus can be approached and handled with comparatively little personal danger. With this arrangement, the laws of corona formation have been studied and the voltage at which corona appears is so definite that it has suggested itself as a means for measuring high voltage. Up to this time, no satisfactory means for the measurement of high voltage has been available.

In addition to accuracy, two other desirable characteristics of a good measuring instrument are, convenience of observation, and a fairly wide range. In the matter of accuracy, the appearance of corona at a definite voltage leaves nothing to be desired. Observations on a given wire repeat themselves to an accuracy closer than the constancy of the usual electric circuit and as closely as can be measured on a low range measuring instrument, that is to say, to an accuracy of 1/10 of 1 per cent.

In the matter of convenience of observation, it would obviously be most inconvenient to have to tell the presence of corona with the eye. This would necessitate making all observations in a darkened space. For a number of years this was probably the determining reason why no effort was made to use corona as a measuring instrument. One of the principal features of the Corona Voltmeter, as developed by the author, is the fact that advantage is taken of another property of the presence of corona, namely, that the air in the immediate neighborhood becomes ionized, that is to say, instead of being an insulator as it is in the normal state, the air becomes highly conductive. Owing to this conductivity a charged electroscope in the neighborhood of the corona forming wire loses its charge with great suddenness. If a charged electroscope be placed opposite a small hole in the outer cylinder surrounding the corona forming wire, and the voltage be gradually raised, the electroscope will remain stationary until corona begins. It is found that at the very instant corona begins the electroscope leaf drops suddenly. The electroscope, therefore, provides a means for telling the presence of corona which is entirely independent of visual observation.



Corona voltmeter for potentials up to 50,000 volts



Exterior and interior views of 100,000 volt corona voltmeter

If the electroscope electrode be made much larger, the number of holes in the outer cylinder being increased accordingly, more ionization or conductivity may be used and the discharge current becomes great enough to cause deflection of an ordinary portable galvanometer, particularly if the latter is in series with a battery or other source of continuous potential. The galvanometer possesses some advantage over the electroscope, notably, that it is less liable to mechanical injury. A third method for the detection of the presence of corona has been found in the telephone. The corona in the open gives out a sound of very small volume. If, however, the outer cylinder containing the corona forming wire has its ends closed, the corona wire being led in through suitable insulating bushings, and if the ear be placed at a small hole in the outer cylinder, the appearance of corona is indicated by a sound of considerable intensity. If a telephone transmitter be placed in a small lateral tube connected with the main cylinder, a receiver connected with this transmitter also indicates sharply the first appearance of corona on the central wire.

The instrument therefore provides three methods in addition to that of visual observation for detecting the first appearance of corona. Numerous careful experiments have shown that all four of these methods are exactly contemporaneous, that is to say, corona appears on a given wire at exactly the same voltage when any one of the four methods, electroscope, galvanometer, telephone or visual observation is used for detecting it.

The question of a wide range of values must also be met. It has been stated that the voltage at which corona appears depends on the size of the corona forming wire, on the shape and position of the opposite conductor, and on the density of the air. A given wire in a given cylinder, under given atmospheric conditions, therefore, would form corona with one, and only one, value of voltage. In order to obtain a wide range of voltage, provision must be made for varying one of the three factors mentioned. Obviously it would be inconvenient to change the size of the outer cylinder or the size of the central conductor, although the latter method is not out of the question. A far simpler method, however, and one which constitutes a principle feature of the new instrument may be found in the variation of the density of the air surrounding the corona wire. The corona-forming voltage is extremely sensitive to variations in atmospheric pressure. The denser the air, that is, the higher the pressure, the higher the voltage at which corona forms and vice versa. A range of pressure between ½ atmosphere and 2 atmospheres, that is, between 35 cm, and 140 cm of mercury will give a range of voltage in one instrument as constructed, from 20,000 to 50,000 volts.

The variations in pressure are accomplished at will by means of an ordinary hand vacuum and pressure pump such as is used for automobile tires, the pressure being read on a suitable gage. Since the pressure is varied, all openings into the tube must be made air-tight. No special difficulty is met in doing this since the range of pressure is comparatively little either above or below that of atmosphere. The temperature in the cylinder must also be read since the density of the air also depends on the

(Continued on page 179)

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Argument for Big Submarines

IF there is a sphere of human activity in which experience should take precedence over theory, surely it is to be found in the Navy and among those officers who are concerned with the construction and operation of its ships. In no branch of the service is this more true than in the submarine service.

There is a popular belief, which cannot be too quickly killed, that the best results for a given expenditure of money for submarines can be obtained by building a large number of small boats, rather than a smaller number of boats of large dimensions.

The experience gained in our war games has shown that the boats which we possess and those which we are now building are too small for successful service with the fleet, or, indeed, at any great distance from the home ports and bases. On this point our submarine officers are unanimous. It is their belief that in future we should build no submarine of less than 800-tons displacement, which is about the displacement of the majority of the very efficient and successful German U-boats.

At present we have about 75 submarines built, building and authorized, and not one of these, in view of recent experiences, can be considered to be seagoing. For our present needs they constitute a sufficiently large fleet for the only duties for which they are suited, namely, harbor defense and coöperation with our coast defenses.

At present we have three large fleet submarines authorized, whose proposed displacement is from 1,200 to 1,500 tons. These, however, are in the nature of an experiment, and it will be some years before they have been constructed and sufficiently tried out to constitute them a type upon which future construction may be based.

The largest of our completed boats are not capable of remaining at sea for a greater period, on the average, than ten days; but a boat of 800-tons displacement, as proved by the actual cruises of the German boats, can keep the sea for 21 days.

A boat of 800 tons will be large enough to embody certain essential characteristics which our existing boats of the K, L and O classes cannot embody because of their limited size; these essentials are habitability, an increased number of torpedoes, increased ammunition stowage, seaworthiness, and an increased submerged radius. Of the above, the most important essentials are habitability and increased radius when submerged.

As to the question of habitability, we cannot do better than quote this experience, as told to us by one of our officers, who spent seven days aboard one of our submarines during the war game of last autumn. The general weather conditions were poor to bad; the sea was lumpy; the weather overcast, with frequent rainsqualls. He informs us that while a submarine does not roll and pitch with such amplitude and speed as a destroyer, she is a first-class "wallower." The general conditions,—the sea, the boat, the living accommodations, . . . could only be described by the one word "hoggish." His description of the living conditions is illuminating, and we give it exactly as told us: Forward torpedo compartment completely filled with torpedoes, eight in number; four torpedoes in the tubes to approximate war condition; in the forward battery compartment 18 bunks; in the central operating compartment 3 cots; in the after battery compartment were mess gear, mess table, and mess stores, and even in this room one man usually had to sleep. Now under these conditions we are not surprised to learn that the efficiency of the personnel was 50%, and that the record of sensickness was, crew 60%, officers 50%; and visitors (unhappy landsmen) 100%. With the crew only 50% efficient, it is not surprising that numerous minor casualties occurred—grounds due to salt water and rain; fire in engine room, due to a leaking fuel pipe; heated motor bearing; broken pin in air compressor; lost fuel suction; grounds on running lights and on steering gear; broken exhaust header, etc.

Returning to the question of the relative value of a few large as against many small submarines, and remembering that the radius of action of the K-class boat is 10 days, as against 21 days for an 800-ton boat, let us suppose that we put $1,500,000 into two 800-ton boats, and again put the same sum into three K's. The K-boat would be able to spend 6 days on the operating ground 300 miles at sea, and the 800-ton boat 17 days. If we substitute four K-boats for three, the cost being $2,000,000, and try them against the two 800-ton boats on a field of operation 600 miles from the coast, the K-boat would spend only 4 days on the operating ground and the 800-ton boat 14 days; then, if we substitute 10 K-boats, costing $5,000,000, for the two 800-ton boats, the K-boat at 1,200 miles distance will have one day on the operating ground as against 10 for the 800-ton boat. To these considerations add the cost of upkeep, and the additional officers and crew required for the K-boats over an equivalent number of 800-ton boats, and it will be seen that upon every ground of economy, strategy and tactics the larger boat is the type which we should build.

We commend these facts to the consideration of Congress when the Naval Bill comes up for final decision.

Fact versus Fiction in Motion Pictures

JUST as there has been a marked change in the American reading public during the past decade or more, as evidenced in the ever-increasing interest with which science and fact stories are received, so, too, the motion picture screen reflects the constantly growing desire on the part of the better-class audience for films depicting actual things and happenings.

In the early days of the motion picture several French producers sent to this country film after film replete with scientific interest—animated histories of the lives of all species of the animal world, from the lowest to the highest; the making of various commodities from the raw material to the finished product; travel pictures showing the strange customs of peoples living in the farthermost corners of the world; striking studies of plant life, and many other similar subjects. But these pioneer producers were ahead of their time, at least so far as America was concerned. The films were not well received by the audiences in this country, who preferred the then insipid story films.

A very different order of things prevails to-day in the realm of films. Within recent years, and particularly during the past twelve months, there has been an alteration in the discrimination of the audience. Scientific films, which would have met with anything but a cordial reception a short while ago, are now shown in most theaters, interspersed in the usual programs of comedy and drama pictures; and judging from the constantly increasing numbers of scientific or fact films released, it is safe to assume that such films must have a strong appeal to motion picture patrons to-day. In a great measure this sudden change of mind in the average audience is due to the fact that pictures are now appealing to a better and more cultured class of people than ever before. Yet more likely it is that the screen, too, is reflecting the tendency of modern Americans to drift away from fiction toward fact: we are fast becoming a scientific people.

Recent films have depicted, among other things, the many wonderful organisms that live in a drop of water, constantly struggling among themselves for their existence. What could be more interesting and startling than the microscopic hydra using its poisonous stings to paralyze its prey? Then, again, there have been films showing numerous new inventions and processes. The European war, with its wonders and tragedies, has been brought home to us on tens of thousands of feet of celluloid ribbon. Events which are making history throughout the world pass daily before our eyes in the theaters only a short time after they have occurred. And in marked contradistinction to these so-called "weekly" or "daily" films are the new "magazines-of-the-screen" films which discuss pictorially the vital questions of the day. In these there is to be found a veritable mine of information that is at once entertaining and highly instructive. Such films are truly scientific.

All this must be considered only as a beginning. As time goes on it would appear that more and more the general public will lean toward science, toward fact, and away from fiction, although the latter will, of course, always be appreciated in its proper place. We are coming to know in a small measure the many wonderful things that exist in everyday life—things which are ever so much more wonderful than the products of the writer's imagination.

The American Exporter and His Competitors

NO other nation has gone so far as the United States in protecting its merchants from the various shrewd and ruthless practices that throttle competition. Far-reaching antitrust legislation has been enacted, both by the States and by the Federal Government, and powerful official agencies—now headed by the new Federal Trade Commission—are engaged in its enforcement.

Unfortunately, when our merchants enter foreign markets they are no longer under the protection of American laws. In fact, the very laws that safeguard their interests at home are, to a certain extent, a source of weakness in their competition with the citizens of countries where combinations in restraint of trade are not only permitted, but even encouraged by the state. Great Britain has no antitrust laws, though they exist in the British colonies. German commerce is almost completely dominated by trusts, or so-called "cartels." Before the war there were no less than 600 of these combinations, embracing practically every industry in the empire. Indeed, in at least one industry —potash—Germany had actually made combination obligatory; and a similar situation has existed with respect to the sulphur industry in Italy and the petroleum industry in Roumania.

In the fierce struggle to retain and strengthen their foothold in international trade in which American industries will find themselves engaged after the present European war, no other factor will prove more formidable than the solidarity of foreign trading interests which will be opposed to the independent and mutually competitive efforts of our own exporters—unless we take a leaf out of the book of Europe's commercial wisdom. The necessity of doing so has recently been urged by the Federal Trade Commission, which has laid before Congress, as evidence of the need of relaxing the antitrust laws in their application to export trade, a striking picture of the advantages hitherto enjoyed by foreign exporters.

"Recognizing the vital importance of transportation facilities," says a report of the Commission, "foreign nations have built up their ocean shipping, have granted low export railway rates, and have combined their land and ocean transportation facilities to give their shippers ready entrance into their overseas markets. Realizing the necessity of banking and credit facilities to finance their transactions, foreign nations have not only established connections with banking houses in every land, but have dotted the map of the world with foreign trade banks of their own. British, French, German and other foreign traders enjoy a peculiar advantage from the billions of dollars of investments made by their fellow nationals in foreign lands, frequently on the express condition that supplies and equipment should be purchased in the country furnishing the funds. In consequence, time and again American manufacturers have found it impossible to sell their products abroad.

The magnitude and efficiency of the German cartels is notorious, but the extent to which industries have joined forces in other countries than Germany for the furtherance of export trade is not so widely known. In France and Belgium, before the war, powerful syndicates directed the iron and steel, coal, glass and other industries. In the silk-ribbon trade there was an international understanding between French and German manufacturers. Italy, Russia, Austria-Hungary, Switzerland, Sweden, Greece, Argentina, Chile and Ecuador have their central organizations which unite the interests of producers in such industries as coal, iron and steel, agricultural machinery, oil, sulphur, superphosphates, cement, matches, chocolate, embroidery, silk goods, watches, cotton goods, condensed milk, canned fish, currants, quebracho, iodine, and cacao. Japanese textile manufacturers have united to capture the great cotton goods market of North China. The whole tea trade of Japan is controlled by a national "tea council." British coal is exported by organizations of mine operators, marketing companies, shipping lines and foreign distributors. British manufacturers of machinery have recently formed a powerful joint agency for the promotion of their foreign trade, known as the "Representation for British Manufacturers, Ltd."

Lastly, our manufacturers and producers in many lines have not only to compete with combinations of foreign manufacturers and producers, but also with combinations of foreign buyers, such as the London "Fixing Board," which daily sets the price of silver for the world, and the German metal-buying organization, with headquarters at Frankfort-on-the-Main, which, in normal times, rules the world's copper market.

It is perfectly obvious that, however much the American people have come to dread trusts and combines as a feature of domestic commerce, something very much like trust organization is going to be indispensable in our export trade. The task of finding methods to promote concerted effort abroad which will not entail or facilitate the restraint of trade at home will not be an easy one, but it must be undertaken as soon as possible.

Naval and Military

The Delay at Saloniki.—A question frequently asked is why has not the allied army of 600,000 men at Saloniki joined in the general offensive of the Allies. A possible answer comes to us from a correspondent, who states that he has recently received a letter from London which states that the inactivity is due to the fact that typhus is epidemic in the entire territory into which these troops would be sent, and that until it was under control there would be no forward movement.

First Use of Burning Liquids.—According to G. E., writing in *Rivista Militare Italiana*, the first use of burning liquids by the Germans was made at Malancourt, February 27th, 1915. The liquid was petroleum kept under pressure in cylinders resembling portable fire extinguishers. Its employment was not due to chance, but was sanctioned by authority, as appears from order 32, October 16th, 1914, Saint Quentin, which gave special rules for the employment by engineer troops of liquids producing smoke and flame.

Oil Engines for Battleships.—An English naval architect in a recent study of the question of applying oil engines for the propulsion of warships states that in the case of a battleship he found that with an equal number of shafts, equal power and speed can be obtained with double-acting two-cycle engines as with steam, auxiliaries being included in each case and the machinery weights being equal. He found that the radius of action could be increased at full speed at least three times and at cruising speeds at least four times.

Cargo Capacity of the Deutschland.—Speaking of the "Deutschland," there has been much discussion as to her cargo-carrying capacity. A naval expert, writing in the London *Engineering*, makes a detailed analysis of the weights, and arrives at the conclusion that out of the 2,000-ton surface displacement there is left only 350 tons as cargo dead-weight carrying capacity. On this basis the writer gives the boat a radius of action of 4,500 miles at 14 knots and 6,650 at 11¼ knots. He arrives, furthermore, at a submerged displacement of 3,100 tons.

A Lesson from the Deutschland.—The "Deutschland" was built and is being operated as a commercial proposition; but at the same time her crossing of the Atlantic and her easy entrance into one of our ports destroys forever the fond belief that the broad western ocean renders us immune from hostile attack. What the merchant submarine accomplished could be done with equal secrecy and dispatch by a war submarine, or, for that matter, by a fleet of them. Modern wars break with the suddenness of a thunderstorm, and the declaration of war may come in the form of war itself, as witness the Japanese attack on Port Arthur.

Bombs in Place of Rifles.—The most radical development of the war has been the substitution of trench warfare, in which the rival armies are held fast and practically immobile in positions which have no flanks, for the free movement of armies in the open field. In the new trench warfare the most radical developments, so far as the infantry is concerned, have been, first, the elimination of long-range rifle fire, and, secondly (a change which is taking place at the present time), the substitution of the modernized ancient hand grenade for the rifle. It is found that in the storming of positions the infantry are less hampered in their movements and do more effective work with the hand grenade than with the rifle, which in hand-to-hand fighting in the trenches and dugouts is more cumbersome than the grenade or bomb.

Airmen and the Allied Drive on the Somme.—Although it has been often repeated in these columns that the airmen and balloon observers are the eyes of a modern army, it is doubtful if the layman fully appreciates to what extent the military organization depends upon its aerial forces. A most striking example is offered, however, in the Somme drive of the Allies. For weeks preceding the drive the British and French airmen were busily engaged in bringing down the German observation or kite balloons, using for the purpose the *avion-canon* machines equipped with 1½-inch quick-firing guns. It is said that a newly designed incendiary shell was used in destroying the balloons, and so effective was the work of the airmen that in a week or ten days' time the German front in Picardy was entirely cleared of the familiar "sausages." The Germans resorted to aeroplanes, but failed to offset the loss of the observation balloons: again the allied airmen were prepared and either prevented the German airmen from crossing their lines or from even leaving the ground. Had the British and French airmen not gained the mastery of the air in the first place, it is doubtful if the drive would have been so successful. As it was, the German artillery was unable to reply effectively through lack of means of observation, and had to rely entirely on maps for finding the ranges.

Science

Germination of Canarium.—The depth of soil which a germinating seed can penetrate varies greatly for different species. Mr. P. J. Wester, of the Philippine Bureau of Agriculture, has recently recorded the case of a tree, the pili (*Canarium ovatum*), which apparently will not survive if planted as much as an inch deep. Some 3,000 seeds of this species were planted at the Lamao experiment station with a soil cover of 2 to 3 centimeters. They germinated satisfactorily, but when the tender seedlings appeared above the ground a large proportion of the plants were unable to pull the cotyledons to the surface without assistance, and the plants broke off just below the cotyledons.

Explorations in the Amazon Valley.—A remarkable campaign of ethnological and archæological explorations, extending over three years, has recently been completed by an expedition from the University of Pennsylvania, led by Dr. William C. Farabee. The expedition established headquarters at Para, and from that point made numerous journeys up the Amazon and its tributaries, visiting some thirty Indian tribes, many of which had never seen a white man, and carrying out archæological excavations. The party made a rich collection of burial urns. In some regions these were found resting on the surface of the ground, never having been placed in the earth.

The Artificial Purification of Oysters.—Recent experiments reported by the U. S. Public Health Service indicate that oysters which have lain in polluted water can be artificially purified so as to be in all respects fit for food by exposure for a short time in water containing a small amount of calcium hypochlorite. This method is analogous to natural purification in pure sea water, but has the advantage that the process may be controlled and assured. The flavor of the oyster is not affected. In many places oysters are now kept for varying periods before marketing in basins or floats, and it is suggested that, with a little alteration in arrangement, these could be turned into suitable purification chambers.

Magnetic Field of a Comet's Tail.—A recent work by M. Baldet discusses the helicoidal filaments observed by M. Quénisset and himself in the tail of Morehouse's comet. He was struck by the resemblance in form between these filaments and the trajectories of cathode rays under the influence of a magnetic field. He was thus led to believe that the rarified gases of the comet's tail were the seat of cathodic discharges influenced by a magnetic field, and he undertook to determine the intensity of this field, as deduced from the curvature of the filaments, according to well-known formula. The intensity of the field as thus determined is very small; viz., something like the hundred-millionth of that of the earth's magnetic field.

Need of New Stations for Measuring Solar Radiation.—Dr. C. G. Abbot declares that the variation of the sun's output of radiant energy is now established, but the influence of this variation on terrestrial climate and the growth of vegetation cannot be well determined unless the results of the Smithsonian Astrophysical Observatory are verified and supplemented by prolonged routine observing at several coöperating stations. Preferably not less than four new stations, widely separated and in relatively cloudless regions, should take up the daily measurement of solar radiation. Dr. Abbot is now planning to establish at least one of these stations, in the near future, at some place in tropical or subtropical latitudes and at an altitude of 4,000 feet or more above sea-level.

Schoolbooks and Eyesight.—Work of unique value is being carried on by a committee of the British Association appointed to inquire into the influence of schoolbooks on eyesight. The committee reports that widespread efforts are being made by publishers and educational authorities in Great Britain to carry out the recommendations as to typography, etc., that it has heretofore published, at least so far as books for young children are concerned. The latest work of the committee deals with the subject of gloss on paper. Glossiness depends mainly upon specular reflection; *i.e.*, reflection similar to that from polished metals. Such reflection is apt to interfere with binocular vision. Scattered or diffuse reflection, as from a fine white powder, is not harmful. Specular reflection cannot be entirely avoided in paper, but it is not injurious to vision unless excessive. When the specular reflection exceeds 56 per cent the resultant glare is likely to be harmful. Writing paper for school use should not give more than 54 per cent specular reflection at an angle of 45 degrees, since young writers often look obliquely at the paper. Colored maps can be produced without extra expense or difficulty on paper conforming to the committee's recommendations. In some cases the effect of using suitable paper is spoiled by the use of glaze in the colors or inks. Apparatus for testing the gloss on paper and other materials has been devised by Mr. A. P. Trotter.

Industrial Efficiency

Oiled Paper has been found to be an excellent material for packing tree seedlings, when shipped in crates. When crates are not used, paper-lined burlap makes a particularly satisfactory wrapper.

A Substitute for Tinfoil.—The American Consul at Breslau, Germany, reports that one of the Breslau tinfoil factories has succeeded in providing a substitute for tinfoil by producing zinc foil. The new product is not to be distinguished from tinfoil and is supposed to render the same services.

A Stop for Electric Cranes.—When a crane goes down for repairs the safety of the repairmen requires that such steps be taken as will make it impossible for a careless operator on another crane to bump into it. Many different kinds of stops have been invented, but it remained for J. A. Jones, M. M., of the South Works of the Illinois Steel Company to invent a portable stop that is quickly attached to the rail of the electric crane and fills all the requirements of an efficient bumper.

Potash Extracted from Wyoming Lava.—It has been known for a number of years that lava in the Leucite Hills, Sweetwater County, Wyo., is composed largely of leucite, a mineral rich in potash. This lava, called wyomingite, is there very abundant, and the total quantity of potash it contains is immense, estimated at 200,000,000 tons, but it has not as yet been profitably extracted. In a series of experimental studies of the reactions of various salts on wyomingite under certain conditions, the United States Geological Survey has obtained interesting results as to the extraction of potash from Wyoming lava.

Swedish Production of Sulphite Spirits.—Sulphite spirits are produced from waste-lye from Swedish sulphite cellulose factories, which was formerly allowed to run into the sea as waste, and yields about 95 per cent spirits. It is estimated that the cellulose mills of Sweden could produce the entire amount of sulphite spirits needed for domestic purposes. The alcohol is obtained at the mills producing wood pulp, and is undoubtedly best adapted as a substitute for gasoline; motors that are especially constructed for alcohol fuel can be operated both effectively and economically with such fuel.

Canada Saves Paper Material.—Similar to efforts in the United States to save all waste rags and paper, as evidenced in the letter of Secretary Redfield of the Department of Commerce, the Weekly Bulletin of the Canadian Department of Trade and Commerce in its issue of April 3rd calls on all housekeepers to save all waste material of this character, so that local organizations and dealers will get them into the hands of the manufacturers. In a later issue of the same publication it is stated that the best kind of waste is book paper, containing none or very little wood pulp. Paper mills and dealers are asked to coöperate with the large numbers of business houses that have already offered to save all waste material of this character.

Potash from Western Utah Lakes.—Potash in large proportions is present in the brines and muds of the Salduro Marsh, a sink in the Salt Lake Desert, about 60 miles west of the southwest edge of Great Salt Lake. From the clays underlying the salt body which covers the Marsh the United States Geological Survey collected samples at depths of 8 to 12 feet, in which the dissolved salts were found to contain from 2 to about 3½ per cent of potash, and 2¼ per cent was found in the soluble salts at a depth of about 4 feet. According to analyses made by the Survey, the brines and muds from the Salduro Marsh contain considerable magnesium chloride as well as chlorides of potassium and sodium, and so are somewhat similar in composition to the deposits from which potash is manufactured in Germany.

Losses Due to Poor American Packing.—In spite of the many admonitions to American shippers there are still a few who seem not to comprehend the seriousness of insufficient packing. An importer of Palermo, Italy, recently requested the American Consul to accompany him to the custom house to attend the opening of 10 cases of leather, inasmuch as the insurance and steamship companies refused to accept any responsibility for the goods, because the bill of lading was marked "old cases." In the interest of the American firm the Consul went to the custom house and found that 5 of the 10 cases had been broken and repaired. They were about 5 by 3 by 3 feet in size and contained about 1,000 pounds of tanned hides wrapped in bundles of 6 skins each. Around each end was a small iron band, but across the end there were no cleats and no bands, nor were they reinforced in the center. From each of the several boxes that were damaged there were missing one or more bundles of skins, a total loss amounting to $345. The ends of the boxes being broken, it was an easy matter for the thieves to pull out one or more bundles unobserved. Had there been cleats nailed across the ends with iron bands passing over lengthwise, it would have been difficult to extract goods.

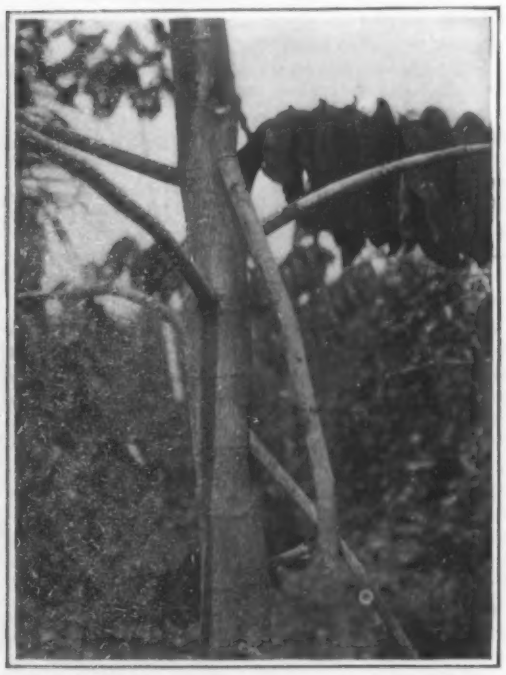
Natural Tree Surgery

How Unprofitable Parts Are Eliminated in the Vegetable Kingdom

By David Brock

NATURE in many instances is her own physician and surgeon, treating her ills without consultation and rendering unto herself most excellent treatment. Healing always takes place without infection and no great strain is put upon the tree itself. Her surgery is bloodless and, so far as we know, painless.

Take, for instance, some of the poplar and willow trees. When the immediate environment is not adapted to the best growth of a twig or branch of these trees,



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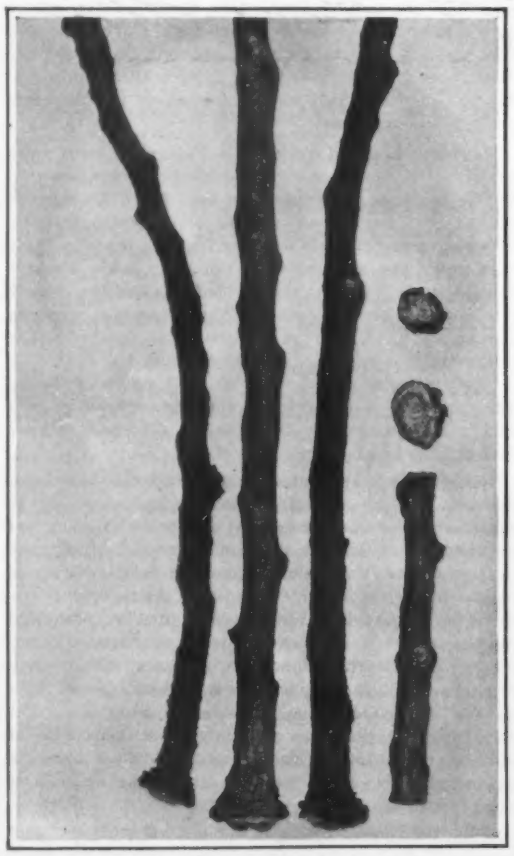

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Rubber tree limbs, showing the abscess-layer process of branch elimination

tion enables the rodman to use railroad spikes that fasten the rails to the ties as the rod supports or turning points. This method of holding the rod has proved very satisfactory and has increased the accuracy of leveling. In previous years the bottom of the rod was hemispherical in shape, and the rod was held on the top of the rail of the tracks. This method was changed because the sloping top of the rail due to the wear of the car wheels was the source of a small error in leveling.

Battling With 300 Tons of Calcium Carbide

By Robt. G. Skerrett

AN accident recently turned the British ship "Matatua" of 6,500 tons into a great acetylene gas plant. The ship was headed seaward at St. John, New Brunswick, when a fire broke out in one of her cargo spaces, and water was immediately turned into the blazing hold. The ship was taken back to dock, and tied up for examination the next day. That night there was an explosion that wrecked the craft and started another conflagration, and to prevent further damage the "Matatua" was flooded and allowed to sink at her pier. The morning following, the cause of the second fire was identified, and from that time on the owners and underwriters were puzzled how to save the ship and at the same time deal with an unusual situation.

The "Matatua" had a miscellaneous cargo, consisting mainly of a large number of popular-priced automobiles. In the spaces between these cars, to steady this bulky freight, had been packed 300 tons of calcium carbide—the latter being in sheet-iron cans holding 240 pounds each. The carbide was distributed in eight compartments, and from the very nature of things decidedly inaccessible after all of the freight was stowed. The heat of the first fire probably opened up some of the carbide tanks, and the water turned in to put out the flames started the second conflagration. It is a fact that calcium carbide when thoroughly and quickly soaked gives off gas without producing any notable rise in temperature. But when the carbide is saturated slowly it generates a great deal of heat, and this may reach a point high enough to ignite surrounding gas. Acetylene forms an explosive mixture with the air if the gas be present in quantities ranging from 3 to 82 per cent.

The problem for the salvors who ultimately took over the work of refloating the "Matatua"—among them the Yankee Salvage Association of New York—was to keep the unrecovered calcium carbide tanks under water, especially while salvage operations were suspended, and to get out of the ship as fast as possible such of the containers as were bared to the air while the wreckers were aboard. This necessitated pumping out the vessel at low tide, and then only in certain compartments, and allowing her to fill again and rest upon the bottom during the following flood and ebb tides. The men could work aboard of the "Matatua" only during the daytime and for the period of slack water between low tide and the beginning of the rising one. It was not considered safe to have them in or on the ship after dark, because that would have required lights, and even had these been electric there was fear that faulty insulation might cause a fatal spark.

Under ordinary circumstances the carbide tanks would have proved tight, even though sealed by wedge-shaped discs, after the fashion of certain unsoldered canned goods. At St. John the difference between high and low tide normally is a matter of 30 feet, and this variation of hydrostatic pressure flexed the heads of the carbide tanks, and caused them to leak progressively instead of filling quickly. This induced gasing and heating, but the latter was not troublesome so long as the containers were submerged. The gas, however, rose and filled overlying confined spaces—the volume of the gas increasing with the falling tide. The salvors dealt with the situation in this way: Tanks giving off gas, which could be detected by rising bubbles, were kept under water and deliberately punctured, so as to drown the carbide; and forced ventilation was resorted to in order to carry off the gas and to stimulate a vigorous flow of fresh air within the ship as she rose above the tide or any of the cargo spaces were drained.

As events proved, none of the tanks could be considered safe, for upon one occasion, when about 20 tons of them had been loaded in an open scow, some of them heated up to a red hot state and started a fierce conflagration. It was necessary to fill the scow with water and to sink her to quench the flames. Despite every precaution, explosions of a minor character occurred within the "Matatua," but happily no one was injured.

In this case the task has been a vexatious and long drawn-out one, and principally because the carbide containers were not absolutely watertight and were packed where they could not be reached readily by the salvors.

First Electric Boat-Lift in Holland

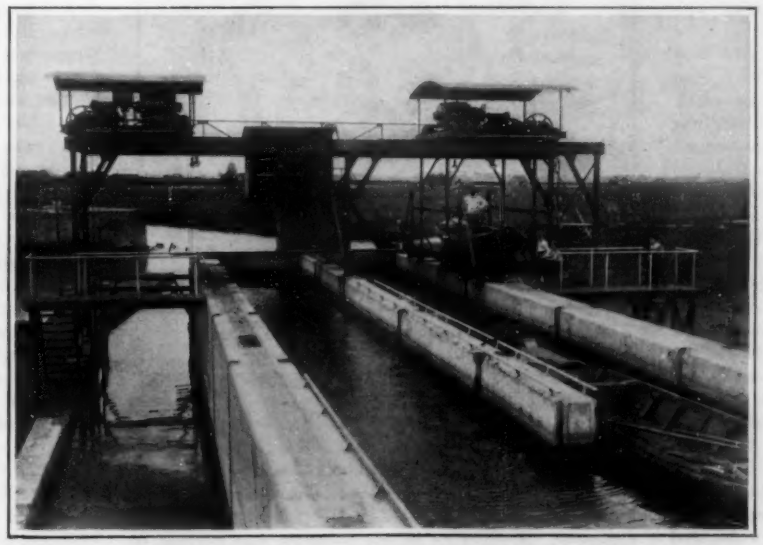
By W. J. L. Kiehl

THE city of Amsterdam, Holland, is supplied with fresh fruit and vegetables by truck gardeners from the surrounding country, who employ the network of canals to transport their goods to market. But there is a considerable difference in water level between the big trunk canal leading into the heart of the city and the one into which empty all the little waterways that crisscross through the fields. It is therefore necessary at the junction point of these to hoist the little market boats into or out of the city canal.

This operation has always been accomplished in a most primitive fashion by means of a large wheel and chain worked by hand. This was naturally very slow, so that an endless procession of boats coming from and going to market could always be seen waiting their turn. For years the victims of this system have been urging some better means of doing this work, without effect, until at last they have taken the matter into their own hands and raised, by subscription among themselves, the sum of fifty thousand florins (about twenty thousand five hundred dollars) to cover the installation of an electric lift. This apparatus has recently been installed and is giving great satisfaction to the originators of the new transportation scheme.

The steamship "Matatua" as she appeared at low tide at the dock in the harbor of St. John, New Brunswick

At the junction point of the two canals a large con-



Electric boat-lift in operation at Amsterdam, Holland

crete basin has been built on the upper level, with inlets at the lower level along both sides. Our engraving shows the process of lifting and lowering the boats, held in a large slat cradle. It will be observed that the two lifting engines run on tracks overhead. The process of lifting consists of lowering the cradle into the water at the lower level until it is submerged (see left-hand side of the illustration). The boat then comes aboard the cradle, which is hoisted till clear of the concrete wall. The engine then runs along its track till the cradle hangs free over the water in the upper level, whereupon the cradle is lowered till again submerged in the concrete basin, and the boat runs off under her own power.

The process is a very rapid one, so that there is no congestion of traffic whatever. It will be noted that two boats may be served at once. A fare of ten cents is charged for each lift, up or down, and this is sufficient to pay all costs of operation, together with interest on the capital invested.

High-Speed Steel Alloy by New Process

IN the manufacture of high-speed steel and turning, planing, and slotting tools made from this material, six processes must be employed before the finished article can be produced. These processes are: Casting the material into ingots; reheating the ingots and forging into cogged bars; reheating again and finishing the bars by rolling or forging to final sizes; annealing finished bars; forging or grinding tools to shape; hardening and then grinding and finishing.

The proprietor of several steel concerns in Sheffield, England, took out provisional patents in that country on October 22nd, 1915, for a new process covering the manufacture of high-speed steel alloy, and claims superiority over the old process in several important respects, according to a report just received by the United States Consular Service.

In manufacturing high-speed steel under the former process an indispensable alloy is tungsten, which in normal times is used to the extent of 14 to 24 per cent. In the new process no tungsten, molybdenum, cobalt, or vanadium is used, and it is stated that the required ingredients are freely obtainable wherever steel is manufactured. Considering the present scarcity and abnormal price of tungsten, especially in neutral countries, this feature of the discovery is claimed to be of supreme importance.

Another claim, and also one on which great stress is laid, is the low cost of manufacture. The tools are simply cast into the proper lengths, after which the cutting edge is shaped and sharpened on an emery wheel. The tool is then ready for working. Four of the six ordinary processes are eliminated. A third claim is that when the tools become too worn for further working, the parts remaining can be remelted and no loss results.

Demonstrations of the discovery have been given in Sheffield. Tools were made in the manner stated, and were tested as against high-speed tools of established makes. The test shown was the turning of a steel bar containing considerable quantities of nickel and chromium, and traces of manganese, carbon, sulfur, phosphorus and silicon. The tools were tested with heavy cuts, reducing the bar one half inch at speeds of about 50 feet per minute, and light cuts, reducing the bar one thirty-second of an inch, attaining a speed of about 150 feet per minute. Tools of one fourth, one half and to 2 inches were tested, all on the bar mentioned, and in each case the result was satisfactory.

The new discovery is suitable only for turning, planing and slotting tools, all of which can be made by casting, not for twist drills or milling cutters. It is stated, however, that the consumption of high-speed steel in the manufacture of tools for which the new discovery is available represents probably 75 per cent of the entire consumption of steel for machine tools.

Patents in other countries are being applied for, and it is proposed in the near future to place the process before steel makers in the United States.

Study of the Volatilization of Platinum

THE results of an investigation made at the suggestion of a committee of the American Chemical Society, on the loss in weight on heating of platinum crucibles of various makes and degrees of purity, are given in Scientific Paper No. 280, issued by the United States Bureau of Standards. The results obtained should prove of considerable value to the analytical chemist in aiding him to eliminate a troublesome source of error.

It is shown that all grades of platinum contain at least traces of iron, that there is an appreciable loss in weight of crucibles heated to 900 deg. C., that above this temperature the loss increases very rapidly with temperature and is greatest for platinum containing iridium and least for platinum alloyed with rhodium.

Ventilation Standards

THE Chicago Committee on Ventilation found that the relative humidity of indoor air should be from 40 per cent to 75 per cent. The "Comfort Zone" is about 64 deg. Fahr. with a relative humidity of 55 per cent. If the humidity is less the temperature demanded rises toward 70 deg. Naturally economy in heating is closely related to the maintenance of about 55 per cent relative humidity which may be secured by the use of free steam or water sprays in the air intake.

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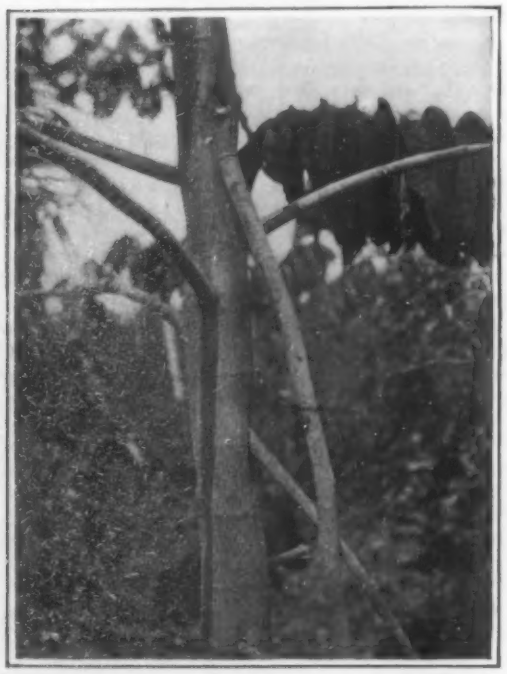

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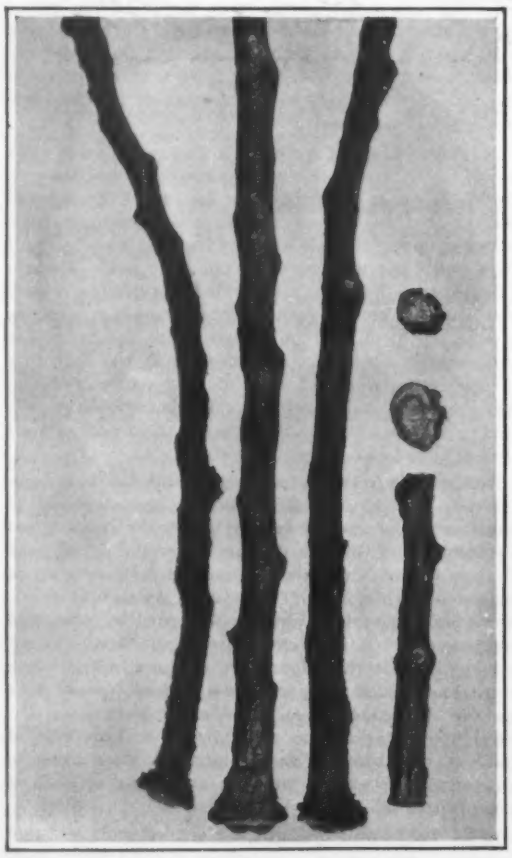

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Throughout the month an officer was engaged in precise leveling in Florida, carrying his line between Cedar Keys and Fernandina, and from Fernandina toward St. Augustine.

The line of precise levels that will run across the southern part of Indiana and thence northward through Indiana and Michigan was continued. These officers are using a rod in the leveling that is somewhat different from the one previously used. The difference consists in a metal rod about 8 inches long fastened to the wooden staff. This is made of hardened steel which terminates in a plane at right to the face of the rod. It is 1⅛ inches in cross section. This peculiar construc-

Rubber tree limbs, showing the abscess-layer process of branch elimination

tion enables the rodman to use railroad spikes that fasten the rails to the ties as the rod supports or turning points. This method of holding the rod has proved very satisfactory and has increased the accuracy of leveling. In previous years the bottom of the rod was hemispherical in shape, and the rod was held on the top of the rail of the tracks. This method was changed because the sloping top of the rail due to the wear of the car wheels was the source of a small error in leveling.

Battling With 300 Tons of Calcium Carbide

By Robt. G. Skerrett

AN accident recently turned the British ship "Matatua" of 6,500 tons into a great acetylene gas plant. The ship was headed seaward at St. John, New Brunswick, when a fire broke out in one of her cargo spaces, and water was immediately turned into the blazing hold. The ship was taken back to dock, and tied up for examination the next day. That night there was an explosion that wrecked the craft and started another conflagration, and to prevent further damage the "Matatua" was flooded and allowed to sink at her pier. The morning following, the cause of the second fire was identified, and from that time on the owners and underwriters were puzzled how to save the ship and at the same time deal with an unusual situation.

The "Matatua" had a miscellaneous cargo, consisting mainly of a large number of popular-priced automobiles. In the spaces between these cars, to steady this bulky freight, had been packed 300 tons of calcium carbide—the latter being in sheet-iron cans holding 240 pounds each. The carbide was distributed in eight compartments, and from the very nature of things decidedly inaccessible after all of the freight was stowed. The heat of the first fire probably opened up some of the carbide tanks, and the water turned in to put out the flames started the second conflagration. It is a fact that calcium carbide when thoroughly and quickly soaked gives off gas without producing any notable rise in temperature. But when the carbide is saturated slowly it generates a great deal of heat, and this may reach a point high enough to ignite surrounding gas. Acetylene forms an explosive mixture with the air if the gas be present in quantities ranging from 3 to 82 per cent.

The problem for the salvors who ultimately took over the work of refloating the "Matatua"—among them the Yankee Salvage Association of New York—was to keep the unrecovered calcium carbide tanks under water, especially while salvage operations were suspended, and to get out of the ship as fast as possible such of the containers as were bared to the air while the wreckers were aboard. This necessitated pumping out the vessel at low tide, and then only in certain compartments, and allowing her to fill again and rest upon the bottom during the following flood and ebb tides. The men could work aboard of the "Matatua" only during the daytime and for the period of slack water between low tide and the beginning of the rising one. It was not considered safe to have them in or on the ship after dark, because that would have required lights, and even had these been electric there was fear that faulty insulation might cause a fatal spark.

Under ordinary circumstances the carbide tanks would have proved tight, even though sealed by wedge-shaped discs, after the fashion of certain unsoldered canned goods. At St. John the difference between high and low tide normally is a matter of 30 feet, and this variation of hydrostatic pressure flexed the heads of the carbide tanks, and caused them to leak progressively instead of filling quickly. This induced gasing and heating, but the latter was not troublesome so long as the containers were submerged. The gas, however, rose and filled overlying confined spaces—the volume of the gas increasing with the falling tide. The salvors dealt with the situation in this way: Tanks giving off gas, which could be detected by rising bubbles, were kept under water and deliberately punctured, so as to drown the carbide; and forced ventilation was resorted to in order to carry off the gas and to stimulate a vigorous flow of fresh air within the ship as she rose above the tide or any of the cargo spaces were drained.

As events proved, none of the tanks could be considered safe, for upon one occasion, when about 20 tons of them had been loaded in an open scow, some of them heated up to a red hot state and started a fierce conflagration. It was necessary to fill the scow with water and to sink her to quench the flames. Despite every precaution, explosions of a minor character occurred within the "Matatua," but happily no one was injured.

In this case the task has been a vexatious and long drawn-out one, and principally because the carbide containers were not absolutely watertight and were packed where they could not be reached readily by the salvors.

First Electric Boat-Lift in Holland

By W. J. L. Kiehl

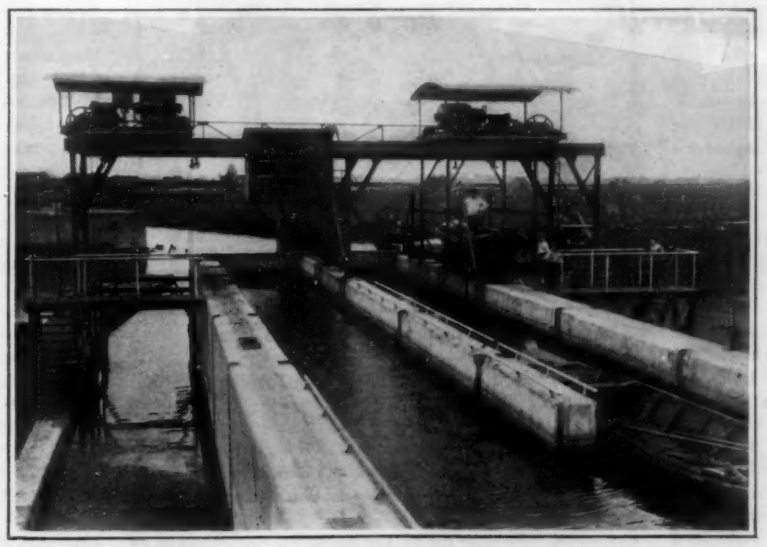
THE city of Amsterdam, Holland, is supplied with fresh fruit and vegetables by truck gardeners from the surrounding country, who employ the network of canals to transport their goods to market. But there is a considerable difference in water level between the big trunk canal leading into the heart of the city and the one into which empty all the little waterways that crisscross through the fields. It is therefore necessary at the junction point of these to hoist the little market boats into or out of the city canal.

This operation has always been accomplished in a most primitive fashion by means of a large wheel and chain worked by hand. This was naturally very slow, so that an endless procession of boats coming from and going to market could always be seen waiting their turn. For years the victims of this system have been urging some better means of doing this work, without effect, until at last they have taken the matter into their own hands and raised, by subscription among themselves, the sum of fifty thousand florins (about twenty thousand five hundred dollars) to cover the installation of an electric lift. This apparatus has recently been installed and is giving great satisfaction to the originators of the new transportation scheme.

The steamship "Matatua" as she appeared at low tide at the dock in the harbor of St. John, New Brunswick

At the junction point of the two canals a large concrete basin has been built on the upper level, with inlets at the lower level along both sides. Our engraving shows the process of lifting and lowering the boats, held in a large slat cradle. It will be observed that the two lifting engines run on tracks overhead. The process of lifting consists of lowering the cradle into the water at the lower level until it is submerged (see left-hand side of the illustration). The boat then comes aboard the cradle, which is hoisted till clear of the concrete wall. The engine then runs along its track till the cradle hangs free over the water in the upper level, whereupon the cradle is lowered till again submerged in the concrete basin, and the boat runs off under her own power.

The process is a very rapid one, so that there is no congestion of traffic whatever. It will be noted that two boats may be served at once. A fare of ten cents is charged for each lift, up or down, and this is sufficient to pay all costs of operation, together with interest on the capital invested.



Electric boat-lift in operation at Amsterdam, Holland

High-Speed Steel Alloy by New Process

IN the manufacture of high-speed steel and turning, planing, and slotting tools made from this material, six processes must be employed before the finished article can be produced. These processes are: Casting the material into ingots; reheating the ingots and forging into cogged bars; reheating again and finishing the bars by rolling or forging to final sizes; annealing finished bars; forging or grinding tools to shape; hardening and then grinding and finishing.

The proprietor of several steel concerns in Sheffield, England, took out provisional patents in that country on October 22nd, 1915, for a new process covering the manufacture of high-speed steel alloy, and claims superiority over the old process in several important respects, according to a report just received by the United States Consular Service.

In manufacturing high-speed steel under the former process an indispensable alloy is tungsten, which in normal times is used to the extent of 14 to 24 per cent. In the new process no tungsten, molybdenum, cobalt, or vanadium is used, and it is stated that the required ingredients are freely obtainable wherever steel is manufactured. Considering the present scarcity and abnormal price of tungsten, especially in neutral countries, this feature of the discovery is claimed to be of supreme importance.

Another claim, and also one on which great stress is laid, is the low cost of manufacture. The tools are simply cast into the proper lengths, after which the cutting edge is shaped and sharpened on an emery wheel. The tool is then ready for working. Four of the six ordinary processes are eliminated. A third claim is that when the tools become too worn for further working, the parts remaining can be remelted and no loss results.

Demonstrations of the discovery have been given in Sheffield. Tools were made in the manner stated, and were tested as against high-speed tools of established makes. The test shown was the turning of a steel bar containing considerable quantities of nickel and chromium, and traces of manganese, carbon, sulfur, phosphorus and silicon. The tools were tested with heavy cuts, reducing the bar one half inch at speeds of about 50 feet per minute, and light cuts, reducing the bar one thirty-second of an inch, attaining a speed of about 150 feet per minute. Tools of one fourth, one half and to 2 inches were tested, all on the bar mentioned, and in each case the result was satisfactory.

The new discovery is suitable only for turning, planing and slotting tools, all of which can be made by casting, not for twist drills or milling cutters. It is stated, however, that the consumption of high-speed steel in the manufacture of tools for which the new discovery is available represents probably 75 per cent of the entire consumption of steel for machine tools.

Patents in other countries are being applied for, and it is proposed in the near future to place the process before steel makers in the United States.

Study of the Volatilization of Platinum

THE results of an investigation made at the suggestion of a committee of the American Chemical Society, on the loss in weight on heating of platinum crucibles of various makes and degrees of purity, are given in Scientific Paper No. 280, issued by the United States Bureau of Standards. The results obtained should prove of considerable value to the analytical chemist in aiding him to eliminate a troublesome source of error.

It is shown that all grades of platinum contain at least traces of iron, that there is an appreciable loss in weight of crucibles heated to 900 deg. C., that above this temperature the loss increases very rapidly with temperature and is greatest for platinum containing iridium and least for platinum alloyed with rhodium.

Ventilation Standards

THE Chicago Committee on Ventilation found that the relative humidity of indoor air should be from 40 per cent to 75 per cent. The "Comfort Zone" is about 64 deg. Fahr. with a relative humidity of 55 per cent. If the humidity is less the temperature demanded rises toward 70 deg. Naturally economy in heating is closely related to the maintenance of about 55 per cent relative humidity which may be secured by the use of free steam or water sprays in the air intake.

Strategic Moves of the War, August 12th, 1916

By Our Military Expert

THE latest news from the theater of war is that, after stemming a powerful Austrian thrust from the Trentino which threatened the communications and rear of the eastern Italian line, Italy's carefully prepared offensive has been launched eastward, through the only feasible gateway into Austrian territory, the Izonzo front, the key of which has been Gorizia and its mountain bastioned bridgehead, the eminences of Monte Sabotino, Podgora and Monte San Michele. These strong points have all been carried by assault after highly concentrated artillery preparation, the Isonzo has been crossed to northward of the city and the key city itself now has passed into the hands of General Cadorna.

Trieste, the main objective of Italian endeavor, lies on the shore of the Adriatic about 20 miles south by east of Gorizia. The southern extremity of the Italian line, in the vicinity of Monfalcone, rests also on the Adriatic and is but 14 miles from Trieste. The way, at casual glance, might have seemed open for advance along the shore of the sea; but an examination of the map, disclosing the barrier of the Carso to the northward, demonstrates the impossibility of such advance so long as Austria held firmly to the plateau and the positions about Gorizia; for any force attempting a seaside advance toward Trieste would have been perilously exposed to flank attack. Until Gorizia and its bridgehead were taken, Italy could not move.

This offensive was originally scheduled for the past spring; preparations for its undertaking were well under way, almost completed, when Austria, who well knew of the prospective drive, forestalled the movement by massing in the Trentino and driving southward with tremendous power. Artillery of all calibers was assembled, the Italian lines were subjected to an overwhelming pounding of shell and, almost with the suddenness of surprise, the Italians were swept back until they clung to the merest edge of the heights which guarded the Venetian plains. A little more time, a little greater pressure, and the line might have been broken instead of bent and the legions of Austria would then have almost held the fair lands of Italy at their mercy.

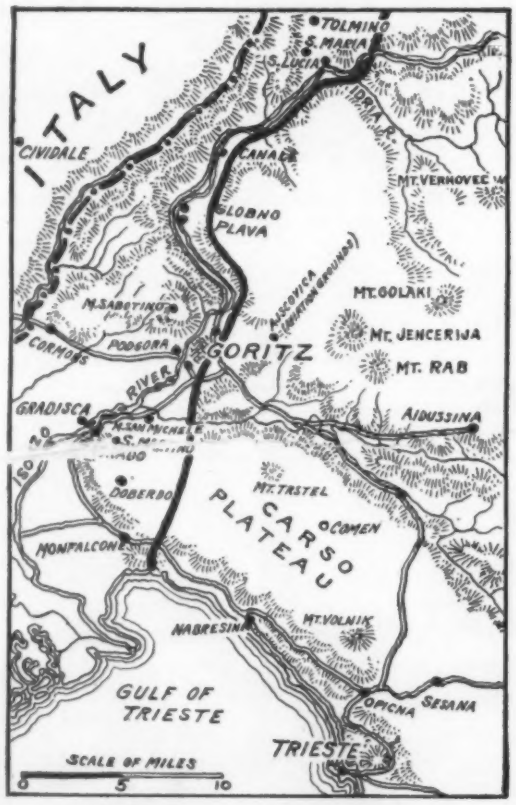
But the line did not break, for Russia, recognizing the needs of the moment and the opportunity created by withdrawal of Austrian strength from the main eastern front to prepare for the Trentino [illegible], struck with overwhelming vigor. The lines of Volhynia, Galicia and Bukovina were imperiled and, in fear lest they instead should break, Austria was compelled to check her mountain march into Italy and rally it to the succor of her broken eastern front. Italy had never let go; tooth and nail she had clung to the very edges of the Asiago plateau while her resources of men and *materiele* were hurried up to stem the tide. With the breaking of the Russian attack it was to be expected that Austria must check her offensive, and Cadorna anticipated it. At the first signs of weakening thrusts he himself sprang forward, and inch by inch began to regain his lost ground before Rovereto.

It was not clear at first whether the Russian assault was but a diversion, a temporary affair; Austria delayed for a little while before stripping her Italian front to meet it. But when town after town, position after position fell before the sweeping claws of the Bear, there was no longer delay in shifting troops to meet the assault; and the propitious hour for which General Cadorna and the Entente High Command had waited, struck. For the first weeks following the beginning of the Russian thrust the Italians redoubled their efforts against their foemen, first to stem the tide of the attack; second, to prevent the detachment of Austrian strength to the east; third, to recover lost territory and creep forward again.

Within a short time after the initiation of Entente activity on the east, preparations were completed on the western front for the so long-heralded allied grand offensive, and the French and British began their pounding in the Somme sector, the move marking for the first time complete coördinated action between elements of the Entente. And now, when Austria in her moment of need has taken every man she can spare from the Italian front, Italy chimes in with her allies, has massed her forces and has cut the difficult knot of troops and territory which held her from the gateway into Austria.

Austria can scarcely be charged with having made a mistake in weakening her Italian front to bolster up another line, for her positions of defense in the former section are undoubtedly the most formidable to an assailant, the most inviting to defense, of any existing battlefront. The need for reinforcement was greater in the east than the necessity for offensive elsewhere, and Austria was therefore compelled to accept the less evil horn of her dilemma as her choice.

There has been expressed considerable dissatisfaction with Italy by her allies, and by observers from neutral countries, not on account of any sympathies these gentlemen might feel for one side or the other, but on account of seemingly lost Italian opportunities and an apparent half-hearted waging of her war. The anomalous condition which existed, with Italy at war with her former ally, Austria, without being officially at war with Austria's active and dominant ally, Germany, rather left the feeling that it was a sheer case of "chestnut pulling" with the least burning of fingers in which Italy was engaged. Perhaps that was true, and perhaps Italy was not aroused to the true situation. At any rate, it seemed so to the writer of these lines. But if the regular reader of the SCIENTIFIC AMERICAN will turn back to an article on the Italian situation printed some weeks ago, he will find the suggestion that the Austrian offensive from the Trentino, which promised such success, might eventually turn out to be a hoist with Austria's own petard through the arousing of Italy to her danger of permitting even a hint of lackadaisical prosecution of the war; and the developments of the last few days



The Italian battle line beyond the Isonzo

along the Isonzo constitute no reason for changing the hypothesis.

Italy's task has been a difficult one. First and foremost she had to sustain a somewhat natural feeling of dislike for repudiating in a moment of need an alliance, even though it were a distasteful one, and for coupling up with the foemen of her previous engagement. Feeling as to the measure was divided in Italy, for up to the time when that country decided what her course of action should be there was at close hand an intimate view of the warfare which was devastating a continent and a world; war in all its horror lay bare and bloody before her. The spectacle was appalling; and no man really wants war. But a national clamor for Italian Irredenta, for lost lands and provinces, the possession of which would restore natural geographical frontiers magnificent in their defensive possibilities, and a patriotic desire to reunite with the Italian people those neighbors to the north and east who are like them in thought, blood, tongue and heart, swayed the balance, and Italy went to war.

Secondly, in summarizing the difficulties with which Italy was beset, comes the military one of making progress against the strong Austrian defenses. The ragged outline of Italy's northern frontier wanders southward in a deep salient from Switzerland to the northern shores of Lake Garda, then northward again to the Carnic Alps. The most forcible thing which strikes one who examines the map is the fact that the Italian frontier is approximately along the southern slopes of the lower ranges, a precarious foothold, while Austria holds an average of 80 miles' depth of successive ridges, the tremendous barrier of the Alps. Should Italy be thrust from her perch, there is nothing behind her but smiling plain, no strong line of defense—and few even weak ones. On the other hand, Austria squats in composure at the forefront of her barrier, secure in the knowledge that if by chance she should be thrust from one advanced line, another and a stronger one is immediately in rear—eighty miles of rear, a rear where a gain of a yard by her opponent is almost the equivalent in difficulties overcome to a mile of open plain.

To the northeast and to the eastward it is the same; mountains and rivers, forbidding crags and bluff-banked streams. There is one gateway only into Austria which is not as difficult as the rest of the frontier line. Forty miles from the Adriatic Sea are the Julian Alps. Between this range and the sea are a number of mountains and detached hills. The land in this so-called gap is by no means a plain, but, with the Carso plateau paralleling the coast from Monfalcone to Trieste, the entire gateway, as compared with the remainder of the territory which hems Italy in, is open and approachable, even though defended by the line of the Isonzo. Italy, then, could not hope to make any appreciable advance to north or northeast; only the Gorizia entrance gave any promise of any success, and Italy's problem has been to hold on the north, the northeast, the east, while she prepared to strike along the only feasible avenue of approach. And now she has struck.

It is too soon to be able to get any idea of what developments will follow the taking of Gorizia. Italy is firmly established on the Carso plateau, and she may be able to continue her attack until Trieste falls—and in Rome they are talking already of an advance upon Vienna. But whether or no any such results follow, a tremendous gain has been made, for Italy has vindicated herself, and her late success must accrue to her alliance as indicative of complete coöperation and accord, and permit her to take a just place beside her allies as one who has fought, has bled and has great strategic gain to show for her share of the task.

Researches upon Ordnance Firing

THE exact causes of deterioration of ordnance cannot be too closely looked into, if it is desired to have a long life for the guns and hence the best efficiency. We extract the following remarks from among a number which are made on the subject of M. Vieille, one of the leading authorities in France and well known for his researches upon smokeless powder. Among other considerations, he remarks that the combustion products of the old charcoal powder contained solid matter, so that the effect of such particles when projected at a high speed must be added to the effect of the gases when it comes to considering the erosions of cannon, and, in fact, the erosion was very strongly marked in the former cannon firing. With smokeless powders, all the products of combustion are now gaseous, and hence there is less erosion produced. The "75" gun, for instance, even when greatly worn by firing, does not present the furrowed appearance due to such causes. But the use of smokeless powder brings about other deteriorations in the interior of the cannon, these effects being due to the fact that the combustion temperature is much higher, especially for powders based upon nitroglycerine, so that what are known as "tempering effects" are much more noticeable here. In general, the starting point of erosions, as the author indicates, appears to be a series of fine cracks upon the inner surface, and the origin of this crackled surface can be traced to a superficial cementation and a very strong tempering which surfaces of soft steel undergo when acted upon by the carbon gases of explosives. When the powder deflagrates, the surface of the metal is rapidly brought to a high heat, but as the source of heat disappears at once, the heat only resides in the surface layer, and this layer undergoes a certain tempering effect due to its contact with the remaining cold metal, which effect is a very strong one under the present circumstances. As to other effects of smokeless powder, M. Vieille remarks that at these high heats there is produced a series of chemical reactions, and the explosion of nitroglycerine produces an excess of oxygen which acts upon the metal. The question of deteriorations to ordnance is a most important as well as a very complex one, and the minute observation of these points is one of the factors which led to the production of such an efficient gun as the "75." In fact, the new French ordnance fires a much greater number of projectiles than was foreseen without deterioration, hence the great practical value of such researches.

German Official Story of the Skagerrak Sea Fight

THE following letter transmitting the German official account of the recent sea fight, is published without the name of the sender. The article by Captain Holwegg will be published next week in the Supplement. —Editor.

My dear Mr. Editor:—

The sea battle off Skagerrak, its proceeding, its results and its meaning will certainly interest you and your valuable "Scientific American."

In pleasant memory of my personal acquaintance with you, I take therefore great pleasure in sending you herewith two copies with sketches giving a description of said battle based on official reports and two copies of an essay written by Captain Hollweg of the German Navy Department.

If you should reprint the articles—which I trust you will—please don't mention my name in any connection with such publication.

On this occasion allow me to inform you that the other day the following news from English source passed my office:

"The 'Scientific American' learned that the Navy Department of the U. S. Navy got official information of the sinking of not less than 127 submarines of the Central Powers in the course of this war."

It goes without saying that such information—should it really have reached the Navy Department—is absolutely unfounded. To say it frankly, while I read it, I laughed so heartily as I seldom did after the beginning of this dreadful war.

Believe me to be, yours very truly,

.....

Captain I. G. N.

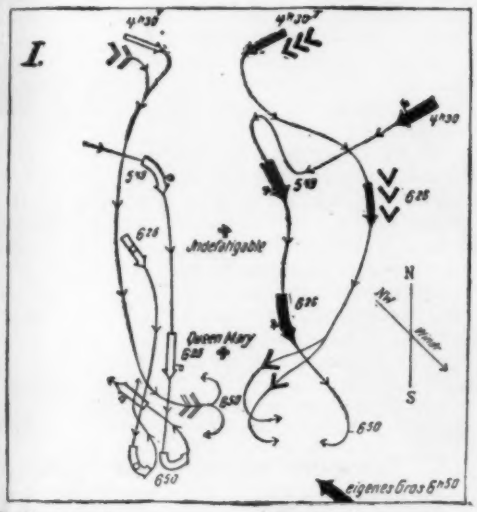
IN the course of one of its customary maneuvers in the North Sea, made, like all previous operations of this character, with strategic designs, which on this occasion carried the fleet into the Skagerrak, our high seas fleet, under the command of Vice-Admiral Scheer, and consisting of three squadrons of battleships, five armored cruisers of the "Derfflinger" and the "Moltke" types, a large number of new and old small cruisers, and several torpedo boat flotillas, was on May 31st in action with the enemy.

At about 4:30 P.M., some 90 miles west of Haustholm, our vanguard of small cruisers comes unexpectedly upon eight small English cruisers of the Calliope class accompanied by 15 or 20 of the newest and largest destroyers of the N class. While our light forces, followed by the armored cruisers of the first scouting group under the command of Vice-Admiral Hipper, are concentrating upon the English, and while the latter are withdrawing toward the northeast, our armored cruisers sight, in a westerly direction, two columns of large ships forming in line toward the southeast. These are soon made out to be the first English battle cruiser squadron under the command of Vice-Admiral Beatty, consisting of six of these vessels, four of the "Lion" and two of the "Indefatigable" class. Our armored cruisers are at once brought into running action with the enemy on a southeasterly course. With clear weather, a light wind from the northwest, and a calm sea, they are drawn into line and at 5:49 P.M., with a range of 13,000 yards, they open fire from their heavy guns upon the superior force of the enemy. After about 15 minutes of action our fire causes a tremendous explosion aboard the last battle cruiser of the enemy line, the "Indefatigable," destroying the ship. At about 6:20 the enemy's line, now consisting of only five battle cruisers, is joined by a strong reenforcing squadron from the west, consisting of five ships of the "Queen Elizabeth" class, mounting the new 38 centimeter guns. These vessels at once go into line with the battle cruisers, and after a brief engagement with our scouting groups the entire squadron thus formed opens fire upon our armored cruisers, which are now opposed by the overwhelming force of ten large ships. To cut down this superiority as much as possible, at 6:20 our torpedo boats are thrown at the opposing line. A bitter fight at close quarters ensues between these and the small enemy cruisers and destroyers that oppose them, and in which our small cruiser "Regensburg" also joins. We lose here two torpedo boats, whose crews are rescued under the heaviest fire by their sister ships; while on the side of the enemy, two destroyers are sunk by our gunfire and two more, the "Nomad" and the "Nestor," put out of action. Later, after our torpedo boats have rescued all survivors, these are destroyed by our main fleet. During the height of this engagement, at 6:30, our accurate fire causes a terrific explosion on the "Queen Mary," tearing her bodily in two. When the cloud of smoke has cleared away, the place she had occupied is empty.

Within a short time our main battleship fleet is seen approaching from the south. The enemy's small vessels at once turn to the north. With this, after an engagement of about an hour's duration, the first stage of the battle is brought to an end. The fast English small craft flee northward, with the German fleet in hot pursuit. Our armored cruisers continue to engage in a duel of rapidly increasing intensity with the "Queen Elizabeth" division particularly, while the battleship division at the head of the advancing line of our main fleet likewise exchanges intermittent shots with these. The enemy's mosquito fleet exhibits intentions of drawing itself into a wide arc before the head of our line. At 7:45 the small English cruisers and destroyers, which till that moment have stood close by the battle cruiser squadron, break away from these; and while the battle cruisers withdraw from the fight—permanently, so far as we have determined—the others make a rapid attack upon our armored cruisers, which by rapid maneuvering evade the torpedoes directed at them. Shortly thereafter our second scouting group, attempting to parry the attack of the destroyers, is the target for a heavy fire from the northeast, our small cruiser "Weisbaden" being put out of action in short order. Portions of our torpedo boat flotillas, which at once launch an attack against the large ships appearing shadowlike through the wall of fog in the northeast, perceive on closer approach a long line of at least 25 battleships. These first seek a junction with their battle cruisers and with the "Queen Elizabeth" division by taking a course between northwest and west; then they turn and steam in a southeasterly direction.

The appearance at about 8 P.M. of the enemy's main battleship fleet, whose nucleus comprise three squadrons of about eight battleships apiece, each attended on the northern wing by three ships of the "Invincible" type and on the southern by three of the entirely new "Royal Sovereign" class, armed with the 38 centimeter guns, marks the beginning of the third

(Concluded on page 182)

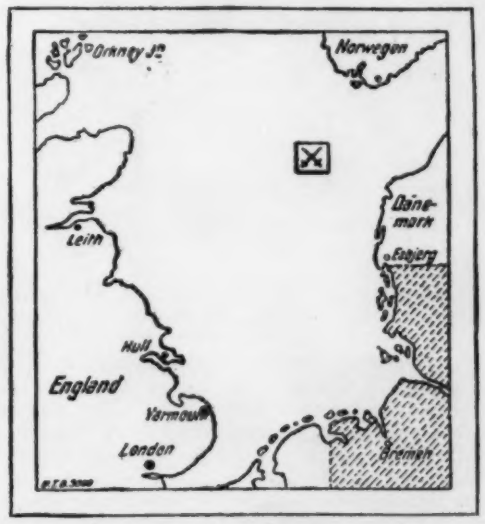


Hostile vessels

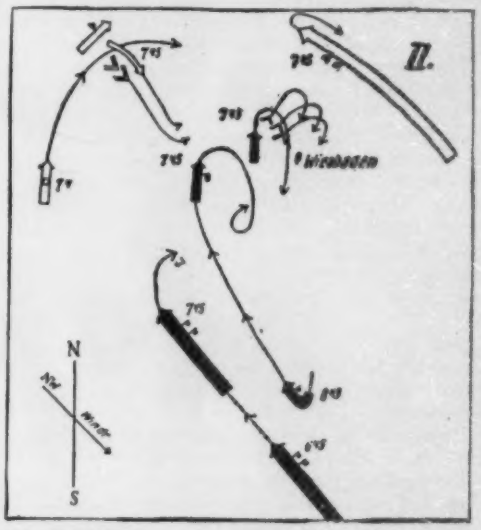
- Small cruisers.
- First battle cruiser squadron.
- Queen Elizabeth division.
- Torpedo boat flotillas.

Our vessels

- Small cruisers.
- Battle cruisers.
- Torpedo boat flotillas.
- Destroyed.



Scene of the sea-fight of May 31st, 1916

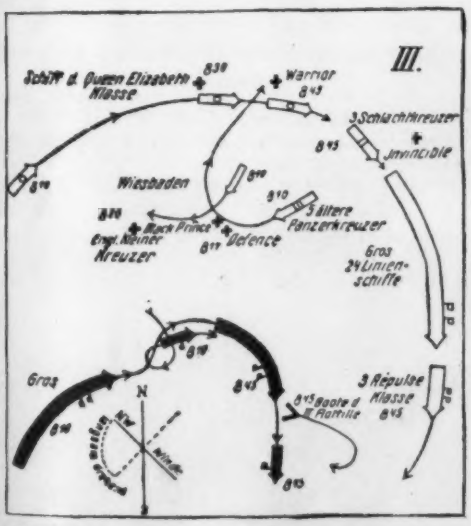


Hostile vessels

- Small cruisers.
- First battle cruiser squadron.
- Queen Elizabeth division.
- Main fleet (battleships).
- Torpedo boat flotillas.

Our vessels

- Small cruisers.
- Battle cruisers.
- Main fleet (battleships).
- Torpedo boat flotillas.

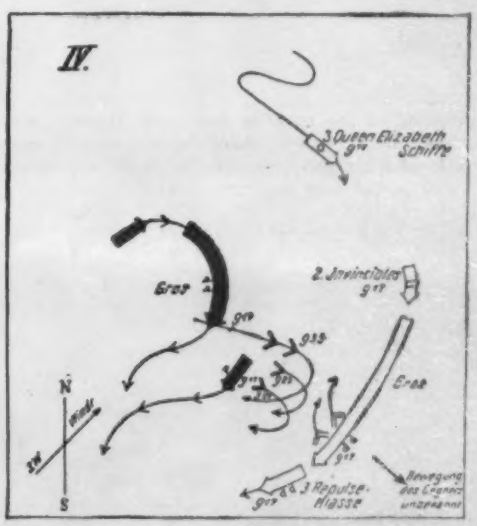


Hostile vessels

- Small cruisers.
- Queen Elizabeth division.
- 3 battle cruisers.
- 5 older armored cruisers.
- Main fleet (battleships).

Our vessels

- Battle cruisers.
- Main fleet (battleships).
- Torpedo boats.
- Destroyed.

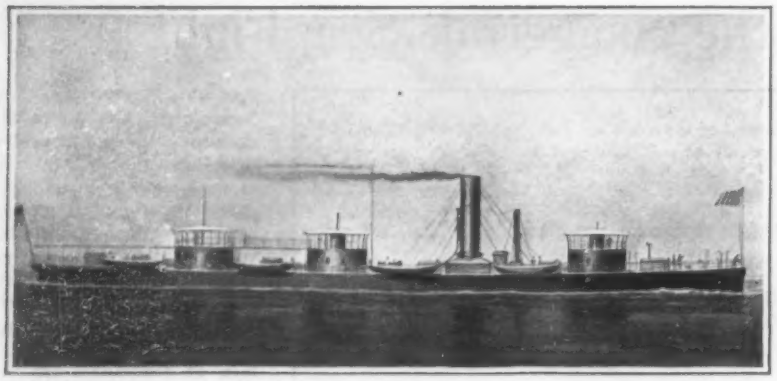


Hostile vessels

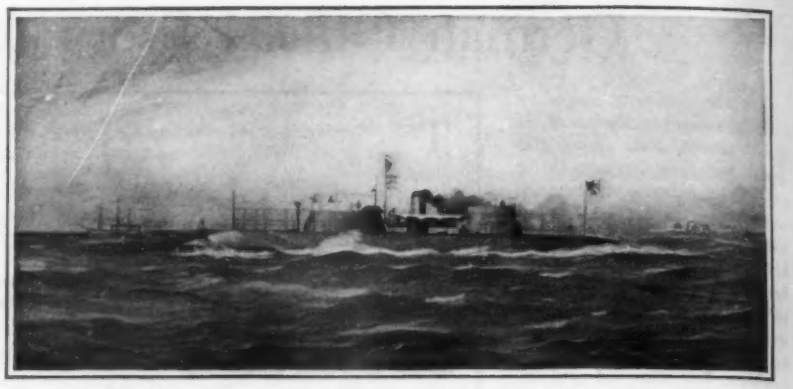
- Queen Elizabeth division.
- 2 Invincibles.
- Main fleet (battleships).
- Torpedo boat flotillas.

Our vessels

- Battle cruisers.
- Main fleet (battleships).
- Torpedo boat flotillas.



An early all-big-gun battleship
U. S. S. Roanoke 1862—Six 11" guns



First step from the low freeboard monitor to the high-freeboard battleship
The U. S. S. Keokuk—1862

The Forerunner of the All-Big-Gun Fighting Ship

The Dreadnought of the Civil War

By Robert G. Skerrett

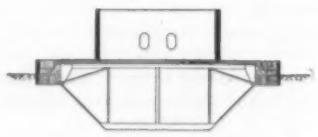
THE all-big-gun fighting ship is not a craft of recent conception as most of the general public may suppose: It has an honorable antiquity of more than half a century, and in these days of rapid changes this is a very considerable period of priority.

When Great Britain brought out her original dreadnought a few years ago, she was proclaimed as the first all-big-gun battle craft, and very promptly rival claims were advanced from a number of directions. Not unreasonably, Ericsson's "Monitor" seemed the logical pioneer, and, in a sense, so she was. But in the broader view of a craft of the battle line she lacked in some vital particulars. She was woefully deficient in habitability, seaworthiness, and speed, and her entire offensive might was centered in a single turret—an arrangement that might have put all of her guns out of action had a chance shot effectually jammed that rotating citadel.

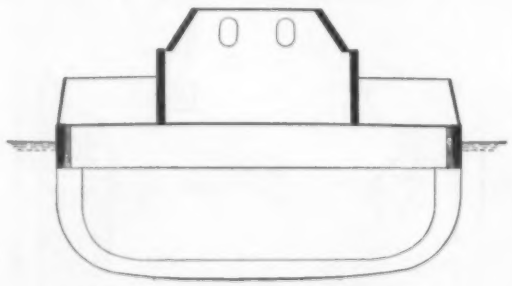
There is no disputing the debt to Ericsson. The contract for the "Monitor" was signed on the 4th of October, 1861, and she led the way for a numerous list of kindred craft. The adoption of the "cheesebox-on-a-raft" type brought into being the so-called ironclad-board of the navy in 1861, and that body of officers examined many novel plans for armored fighting ships. One of the most unique was a design tendered by C. W. Whitney of New York, and, strictly speaking, she may properly be looked upon as the first of the seagoing all-big-gun armorclads. In other words, the ship that blazed the way for the modern dreadnought.

The "Keokuk," for so the vessel was named, was contracted for on the 25th of March, 1862, and built by J. S. Underhill at the Dry Dock Iron Works, New York city. She was launched on the 6th of December, following. The "Keokuk" was classed as an iron-plated, shot-proof steam battery: she had a length of 159 feet, a beam of 36 feet, and a depth of hold of 13 feet 6 inches. Instead of one turret, the "Keokuk" had two, and in each of them was mounted a single 11-inch gun. This insured one weapon being effective even if the other were disabled in any way. The idea of independent armored fighting stations for the guns was thus inaugurated. The hull form was a distinct improvement upon that of the original "Monitor." The freeboard was higher though covered with defensive plating, and undoubtedly had the "Keokuk" been called upon to fight in a seaway she could have done this when the "Monitor" would have rolled about helplessly.

The "Keokuk" was provided with low-pressure condensing engines capable of driving the vessel at the rate of 10 knots, while the "Monitor" had a speed of 6 knots and her class which followed immediately after could boast of no more than 7 knots. In her day, the "Keokuk" represented high speed, notable powers of attack; theoretically, sturdy defense; and the capacity to go to sea in heavy weather. Besides these characteristics, the "Keokuk" had a ram bow; and her accommodations for officers and crew were a big improvement upon the "Monitor" conceived but a short while earlier and scarcely more than launched when the plans for the "Keokuk" were drawn.



Cross-section of the original monitor

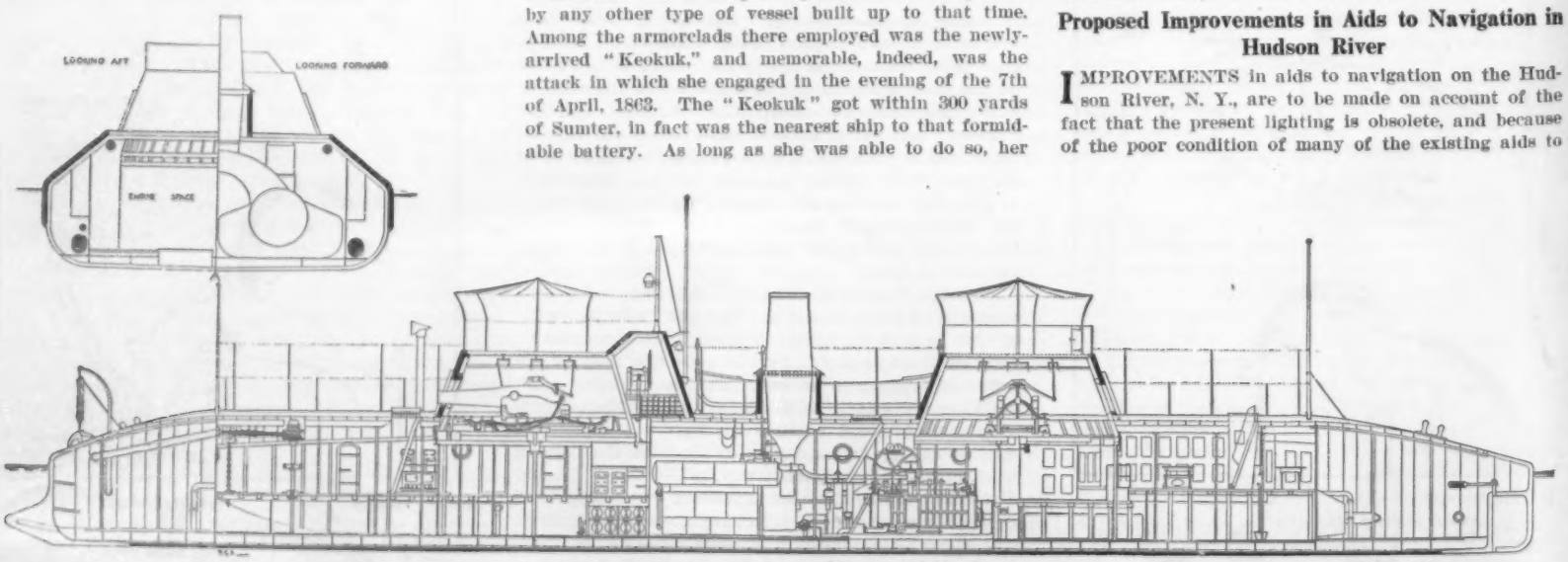


Cross-section of the battleship Oregon

It is a matter of history now that the monitors assembled before Charleston did more in battling with Fort Sumter than could possibly have been accomplished by any other type of vessel built up to that time. Among the armorclads there employed was the newly-arrived "Keokuk," and memorable, indeed, was the attack in which she engaged in the evening of the 7th of April, 1863. The "Keokuk" got within 300 yards of Sumter, in fact was the nearest ship to that formidable battery. As long as she was able to do so, her gallant commander made the best practice possible with the "Keokuk's" guns, but the battle was too uneven. She was struck 90 times in half an hour, and 19 of the shots went through her broadside armor, while her turrets were pierced in a number of places. No wonder that her forward gun was put out of action at an early stage. Through desperate efforts she was kept afloat until the following morning, when the sea becoming rough she filled and sank.

While the "Keokuk" was not able to stand the blows that most of the monitors present at the time survived, and as a floating battery was probably not their equals, still she embodied features susceptible of improvement which unquestionably heralded the coming of the battleship of later years. It is probably no exaggeration then to say that this novel craft was the middle step between the monitor and the all-big-gun fighting ship which we are pleased to-day to call the dreadnought. It is curious that the naval architect breaking away from tradition at that time could not have realized the possibilities of the "Keokuk" type and have rounded it out into a more perfect fighting machine. She came into being only to be forgotten.

It has been declared by some students of naval history that the U. S. S. "Roanoke" was really the first of our all-big-gun fighting ships, and this is largely based upon the fact that the vessel carried three turrets in which were mounted six 11-inch guns. As will be remembered, the "Roanoke" was originally a frigate of the "Minnesota" class, and was razeed in 1862 until she had a freeboard about three times greater than that of the monitors then building. Upon her were placed three Ericsson turrets at the Novelty Iron Works, New York. She saw service for about a year in the North Atlantic Squadron, but the vessel was not satisfactory. The weight of her turrets caused her to roll dangerously and her hull was not strong enough to carry them properly. It has been said that "the thrust of the turret spindles on the keel when the turrets were being keyed up for action always threatened to force out the bottom." Besides, there was also the weight of the plating upon her deck and the 4½-inch iron placed upon her sides. For the better part of her career as an armorclad the "Roanoke" was used for harbor defense in the sheltered waters adjacent to Fortress Monroe.



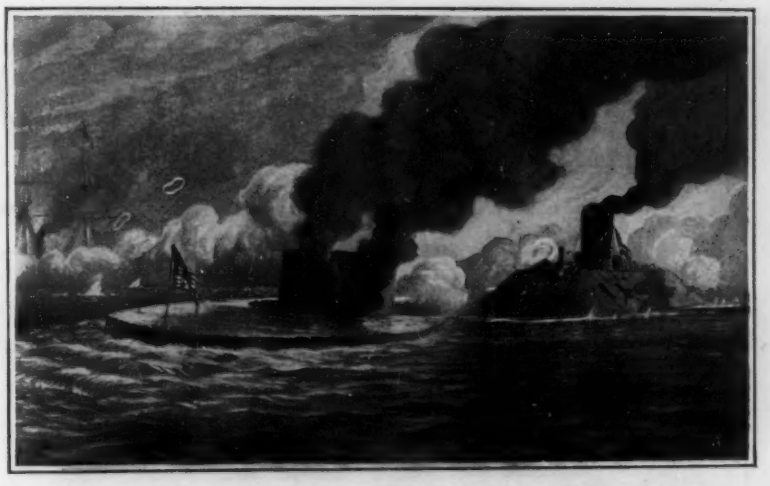
Longitudinal and cross-sections of the "Keokuk"

Proposed Improvements in Aids to Navigation in Hudson River

IMPROVEMENTS in aids to navigation on the Hudson River, N. Y., are to be made on account of the fact that the present lighting is obsolete, and because of the poor condition of many of the existing aids to

navigation while they are so constructed that it is impossible to keep them in operation when the ice commences to move. The plans for improvements include a modern system of flashing lights, on concrete foundations so as to resist ice damage. This is required on account of the large freight and passenger traffic. The sundry civil act approved July 1st, 1916, appropriated $100,000 for improving the aids to navigation and establishing new aids on the Hudson. Instructions have been given by the Lighthouse Service of the United States Department of Commerce that the work proceed as promptly as possible.

The work contemplated to carry out the provisions of this appropriation consists of rebuilding the light and fog signal at Stony Point; improving existing aids at Staats Point, Lamphere Dock, Four Mile Point, West Flats, and Con Hook, by providing brighter and flashing lights; increasing the candlepower and providing fog signals at Jeffreys Hook; rebuilding decayed foundations and providing new towers and brighter lights at Bear Island, Cow Island, Nine Mile Tree, Roha Hook, Fibe Hook Island, New Baltimore, Fitchs Wharf, Percy Reach, Catskill West Flats, Livingston Creek, Upper Coal Beds, and Esopus Island; rebuilding tower and fog bell house and improving light at West Point, and establishing new lights at Van Wies Point, Barrytown Bluffs, Magazine Point, and Anthony's Nose, improving in all 20 existing lights and establishing 4 new lights.



The battle between the "Merrimac" and "Monitor" in Hampton Roads

The Occultation of Saturn on August 25th

By William F. Rigge

A RARE celestial spectacle is in store for the lovers of astronomy. On the early morning of August 25th the waning moon will eclipse the planet Saturn.

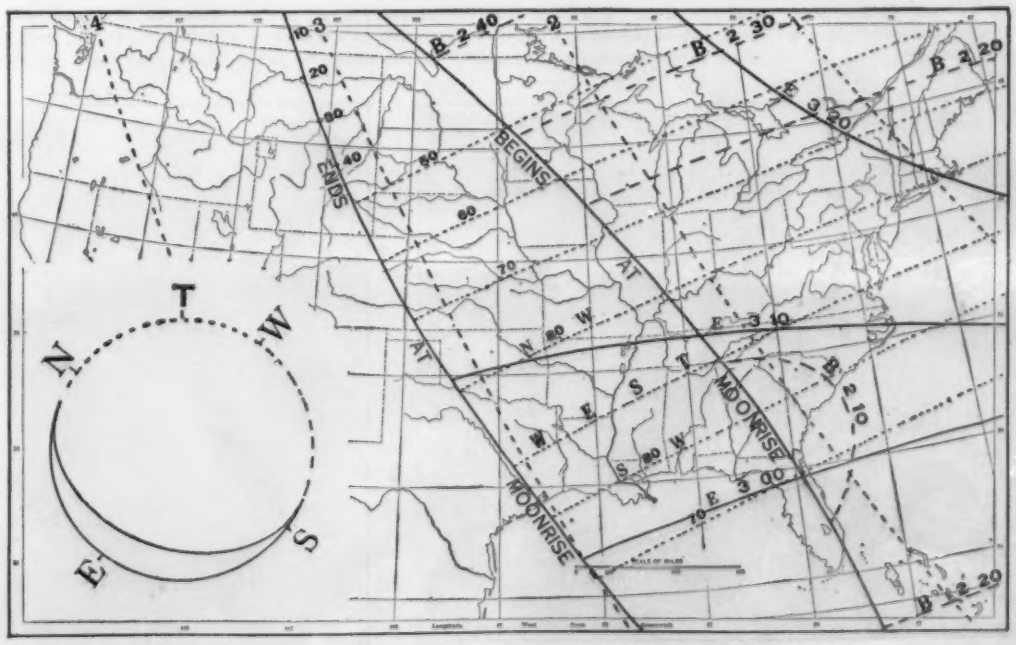
The moon, our nearest celestial neighbor, is continually passing between us and the stars, and thereby intercepting the light of those with which it happens to be in line. It is then said to eclipse or to occult them. While such occultations are happening continually, there are very few that we can or care to observe. For out of the large actual number we must first strike out those that happen when the moon is below our horizon and is therefore invisible to us. Then we must take out those that occur in the day time, those that happen when the moon is full or nearly so, when the weather interferes, and when the hour is inconveniently late or early. In examining the small remainder for bright stars and planets, we will readily be convinced that the occultation of Saturn on the 25th is, in spite of its qualifying circumstances, well worth observing by those privileged to see it. Adding the argument of fact to that of theory, let me state that the last occultation of a bright star visible in the United States at a convenient hour was that of Antares on June 26th, 1912. The last occultation of a planet was that of Mars on January 28th, 1912, and the last occultation of Saturn occurred on July 10th, 1900.

The circumstances of the coming occultation are all detailed on the annexed map. For all places situated on the curve marked "Begins at moonrise," the planet will disappear behind the moon at the moment when the latter appears above the horizon. East of this curve the occultation will begin some time after moonrise. The broken lines B 2/10, B 2/20, B 2/30, B 2/40, give the central times of this beginning. Eastern time will, of course, be one hour later.

The curve "Ends at moonrise" is drawn through the places at which Saturn will be seen to reappear from behind the moon at the time it rises. The central times of the end of the occultation are indicated for regions east of this curve by the full lines marked E 3/00, E 3/10, E 3/20. Between the curves "Begins at moonrise" and "Ends at moonrise" the moon will rise with Saturn hidden behind it. West of the latter curve the occultation will not be visible. The dotted curves marked 1, 2, 3, 4, on top, indicate the full hours of the central times of moonrise. By allowing four minutes of time to a degree of longitude, the time of moonrise may be found for any place in the United States. And in the same way by estimating the distance of the place of observation from the lines of beginning and ending in tenths of their distance apart, the nearest minute may be found.

The moon will be a beautiful waning crescent on the morning of the 25th. The insert in the lower left hand corner of the map shows its appearance. NSEW are its cardinal points, which are the same for all observers, the point N being nearest the north star. The line N S inclines considerably to the left at the time, so that some point near T will be on top for observers in the United States.

As the moon moves relatively eastward, the planet will disappear at its bright edge. In using a telescope it is desirable to know at what point of the moon's edge—or limb, as astronomers prefer to call it—Saturn will emerge. This information is furnished by the dotted lines on the map. On the line marked WEST the planet will be seen to reappear at the point W on the moon's limb. On the lines marked N 80 W and S 80 W, the reappearance will be ten degrees to the N and S respectively of W. And so on for the rest, on all the lines above the one marked WEST the emergence will be in the N W quadrant, and on those below it in the S W. Finally it may be noted that the horns of the moon's crescent are about fifteen degrees away from its N and S points.



Where and when the occultation of Saturn may be seen

The Current Supplement

BIG ranches have been features of our Western country for a number of years, but these enterprises have been devoted to a single product, usually grain, and, therefore, cannot be properly classed as farms, in the generally accepted meaning of the term. Moreover, most of the Western ranches have been in the nature of individual enterprises, and in no way connected with what is popularly called "Big Business." Now, however, the moneyed interests have turned their attention to genuine farming on a manufacturing basis, and have created a genuine farm out of raw materials, so to speak, where garden truck will be raised on an immense scale; and this farm is located in the supposedly crowded East. *How Wall Street Tills the Soil*, is a most interesting description of this unique enterprise, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2120, for August 19th; and it is accompanied by a number of excellent illustrations. *The Protoatom of a World* is a suggested cosmogony to account for the evolution of a stellar system without the necessity of matter being originally present. *New Devices to Aid the Wounded* illustrates and describes a number of ingenious devices to assist victims of the war who have lost the use of their limbs by injuries, causing paralysis. *Wooden Soled Shoes in Germany* illustrates and describes a new product resulting from the necessities caused by the war. *The Differences Between Gasoline and Steam Motors, and the Question of Torque* will answer many questions often asked by owners of automobiles. *Optical Glass* tells about the various qualities required for making instruments, together with something of the history and methods of producing them. *Carillons and Chimes* tells how choirs of bells are rung, and gives facts relating to the making and tuning of bells. *The Iron Bacteria* gives much valuable information regarding a curious class of organisms, their physiology and their actions on waters containing iron solutions, and is accompanied by numerous illustrations. *Farm Water Supplies* gives useful information on how pollution is caused, and precautions that should be taken to insure a pure supply. Other articles include *The Amount of Water to Use in Concrete, A Simple Test for Nickel Plate* and *New Data on the Archaeology of Venezuela.*

New Record Made in Production of Charts

DURING the fiscal year just concluded the United States Coast and Geodetic Survey printed 162,510 copies of charts for distribution. This exceeds the previous record of 143,668 copies in 1914 by 18,842. Notwithstanding the increased output, the survey is unable to keep pace with the demand.

The report for June shows that 12,450 charts, 390 coast pilots, and 200 tide tables were issued in the closing month of the fiscal year. In the preparation of publications for the assistance of mariners, one drawing for a new chart was completed; extensive corrections were made on 31 plates; 4 new charts and 3 new editions of charts were printed, and 66 reprints were made.

The survey also reports work on field revisions of coast pilots. The officer assigned to that duty, before taking up the field revision of the Pacific Coast Pilot, organized a temporary party and chartered a launch at Seattle, Wash., proceeding on June 5th to the entrance to Juan de Fuca Strait to make an examination of a reported break 1½ miles southwest of Tatoosh Island. The rock was located, and has at least found depth of 45 feet over it. This depth accounts for the break seen in heavy weather, while present information indicates that it is hardly a menace to any vessel entering Juan de Fuca Strait.

Improved Methods of Utilizing Lignites

ACCORDING to the opinion of the scientist in charge of recent experiments at the University of North Dakota, great improvements can be made in the methods of utilizing lignite. In the present work at the university the equipment of the college of mining engineering of that institution has been utilized. The value of the inquiry lies in the vast deposits of lignite in the West Central and Western States. In North Dakota alone it is estimated that the deposits cover approximately 32,000 square miles, many of them being 10 to 15 feet thick. The Federal Government also controls great tracts underlaid with this material.

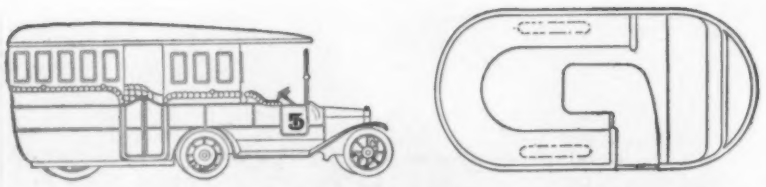
It is believed that better results than in the past can be obtained in the manufacture of cheap gas for power and other purposes, and that the making of high-grade fuel briquets can be put on a commercially satisfactory basis. The report on the experiments is printed as Bulletin 89 of the Bureau of Mines, "Economic Methods of Utilizing Western Lignites."

A Trailer that Converts any Automobile into an Eighteen-Passenger Bus

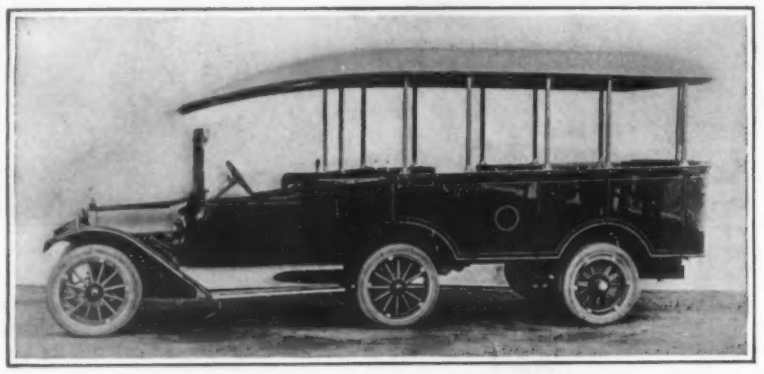
A TWO-WHEELED TRAILER for use with any light automobile, resulting in a six-wheeled bus that can accommodate 15 to 18 people with a cost of operation about the same as an ordinary jitney, is the invention of R. B. Fageol of San Francisco. The combination vehicle is said to include the good points of the jitney, such as low operating cost, curb loading, quick get-away, comfort of riding, with the good points of the trolley car—greater capacity, responsible management, and free transfers to existing lines. When operated by street car systems, the new vehicles will serve as feeders from outlying or adjacent districts, for use where service by trolley cars is not profitable or is objected to by residents, and for testing out extensions of rail systems. On the other hand, existing jitneys can be remodeled at small cost and enter into the construction of the new flexible car, so that a jitney driver can utilize his present car and at small cost increase capacity and profits materially.

The new bus is light, quiet, easily controlled, turns in the same space as a car half its length, and, by an ingenious device, the rear wheels track in the path of the wheels in front, which means that it turns without cutting corners and is easily able to worm its way among traffic in crowded streets. In case anything happens to the engine member, necessitating adjustment or repairs, it is easily disconnected from the rest of the vehicle and replaced by another engine, so that the whole vehicle need not be out of commission. The smaller trailer accommodates from 15 to 18 people, while a larger type for interurban service has a seating capacity of 25 people. The load is carried chiefly by the rear wheels on the principle that a motor can pull three or four times what it can carry on its back. For this reason a low priced car of light construction can be employed, thereby increasing its capacity from four passengers besides driver to twelve.

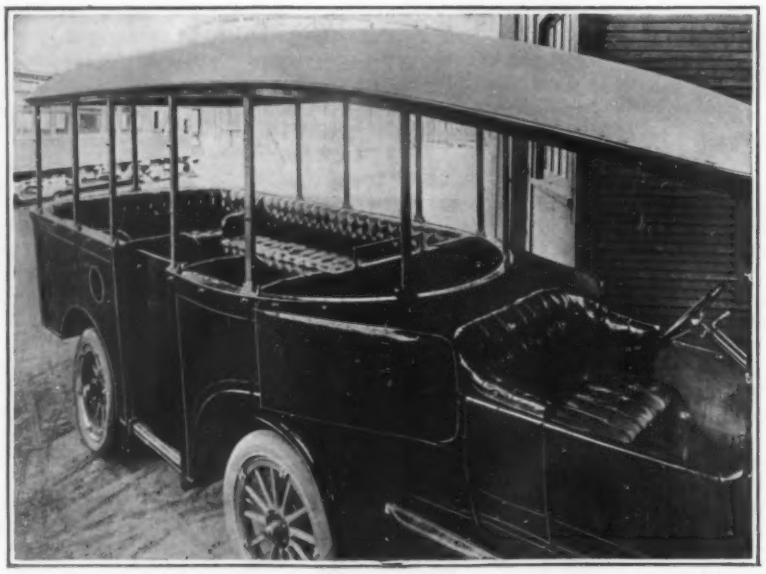
The first car employing Mr. Fageol's idea was driven from Los Angeles to Fresno for service in the latter place, a distance of 250 miles, over Tehachapi Mountains and the Mojave Desert, in 10 hours and 30 minutes. It is reported that the car arrived at its destination in perfect condition for service. The gasoline consumption was less than one gallon for 18 miles, and its easy riding qualities even over 50 miles of very rough road were particularly noteworthy. The car was put in service several weeks ago by the Fresno Traction Company, representatives of many street railways on the Pacific Coast being present. It was a matter of general remark that the car rides more comfortably than the usual touring car and not at all like a bus. The three-point suspension of the passenger-carrying member has been offered as the reason for the smooth riding qualities of the car. During the trials the car was readily turned around in narrow city streets and was also backed in a circle several times for the benefit of the moving picture men who were present with their cameras.



Elevation of the new trailer and automobile, and a plan of the seating accommodations



Newly invented trailer for converting a light automobile into a bus seating 15 to 18 passengers



Another view of the new trailer, showing the seating arrangement and method of coupling to an automobile

Fabric Shields for Protecting Soldiers Against Shrapnel and Bullets

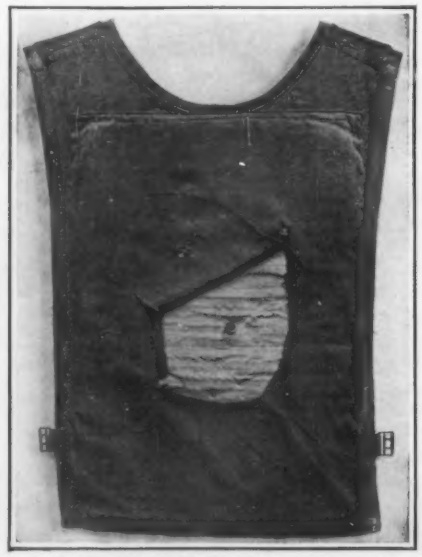
WITH the object of offering protection to soldiers against bullets and shrapnel splinters, an English concern has developed a fabric which, although of light weight, is said to astonish everybody who has had the opportunity of testing its impenetrability.

For the present the new fabric is being made into shields of two types: first, the single shield which is worn in front and serves to protect the wearer from bullets; second, double shield for protecting the chest and back. With regard to the latter type, it has been found in the present war that some protection for the soldier's back is quite necessary because of the high percentage of casualties arising from flying shrapnel.

Obviously it is not possible to give a detailed account of the impenetrable fabric, but the accompanying illustration showing a bullet which has been stopped by one of the shields is interesting. It will be noticed that the pad of fabric is encased in an outer covering of khaki fabric, the former being a booklike section with several pleats to the inch, chemically treated after it is made up and the whole inserted within the outer jacket and sewed up. The other illustration shows a test made on a shield placed against an empty carbide tin with a view to demonstrating the ability of the fabric to protect aeroplane tanks and other equipment. Although two bullets have struck the shield on the tin, neither of these has succeeded in penetrating the shield. The only damage to the tin is in the form of slight indentations.

The writer has had the opportunity of examining two bullets that were fired from a service revolver at eight paces, with a bullet velocity of 750 feet per second, at one of the fabric shields. The lead bullets plainly show the fabric markings on their mashed noses, demonstrating that the fabric was the last thing struck by them before they came to a halt in the folds of the shield.

Testing the impenetrability of a fabric shield placed in front of a tin tank



A fabric shield which withstood a revolver bullet

Lightning Danger of Trees

RECENTLY statistics have been collected in different parts of Germany as to the danger of different varieties of trees being struck by lightning. The result has been the following percentages: Oak, 32.1; larch, 9.5; fir, 3.8; pine, 1.8; scotch fir, 0.9; birch, 1.4; beech, 0.3; and alder, 0.0.

The character of the soil is an important factor among others as to the lightning danger. Trees growing in moist soils and along the courses of rivers and brooks and in the neighborhood of ponds are especially exposed to the danger. Trees with deep penetrating roots are more easily struck than those with shallow roots nearer the surface. As proof of this is the greater frequency of the apple tree being struck than the pear in the same orchard. It is also stated that the poplar stands first in danger before the oak, elm, ash, gum and pear tree. Together with the beech the least attractive to lightning are chestnut, maple, alder and mountain ash. Between these two groups stand the apple, cherry, linden and the walnut trees.

During thunder storms it is advisable therefore to avoid oaks, poplars, all kinds of pine, willows, elm and pear. If shelter is taken under a tree, which is always dangerous, it should not be under one standing alone. The planting of trees which attract lightning is recommended in the neighborhood of houses, especially poplars, partly to prevent the possibility of the rebounding of the lightning. It is well to provide such trees with metallic rods to make them really effective conductors of lightning.

A Collection of the Commercial Marbles of the United States

A COLLECTION of commercial marbles which, when completed, will embrace samples of all those produced in the United States and several important types from foreign countries, is being made by the United States Bureau of Standards. During the month of June, the bureau prepared specimens for expansion tests of 50 commercial marbles. Freezing tests were made on 14 of these. During the progress of this work, 61 samples of polished marble, 8 by 12 inches, have been received from various quarries in the Eastern and Southern States, and plans have been worked out for displaying these to permit persons interested to study and compare the different types.

Insulating Aluminum Wire

ALUMINUM trioxide, or rust as it might be called, is a poor conductor of electricity. A firm, coherent coating of this may be deposited on an aluminum wire by passing it as cathode through a bath of borax or water glass and then through a second bath in which it is made the anode. Two wires covered with the oxide and twisted together have stood a pressure of 200 to 500 volts before short circuiting through the film. In making the film a high current density is used and the voltage brought up quickly.

Pneumatic Coasters for Coasting on the Ocean Surf

TO water sports there has lately been added still another form of diversion, namely, a pneumatic coaster for surf riding. The latest sport makes use of a mattress-like raft which is inflated with air. Passengers ride on it much in the same way as on a sled, while the tumbling breakers or waves cause the pneumatic coaster to glide up and down the hills and hollows of the surf. The sport is said to be quite as exciting as its counterpart, actual winter coasting, and it is fast becoming the vogue at many of the country's leading beaches.

A pneumatic coaster with its load of three passengers

Captured German Mine-Laying Submarine

SOME time last spring, one of the British patrol fleet ran across a small German submarine, which the crew was abandoning because of an internal fire. She was made a prize of war. The boat was towed into an east coast port, where the two photographs of the little craft which we produce herewith were taken.

Anyone who is familiar with the appearance of the typical German U-boat will see at once that the U-C 5, as she is called, is a totally different type of boat. A noticeable difference is the narrow deck, sloping downwardly from the conning tower to bow and stern. The standard U-boat is distinguished by a broader deck, which run without any sheer straight from stem to stern.

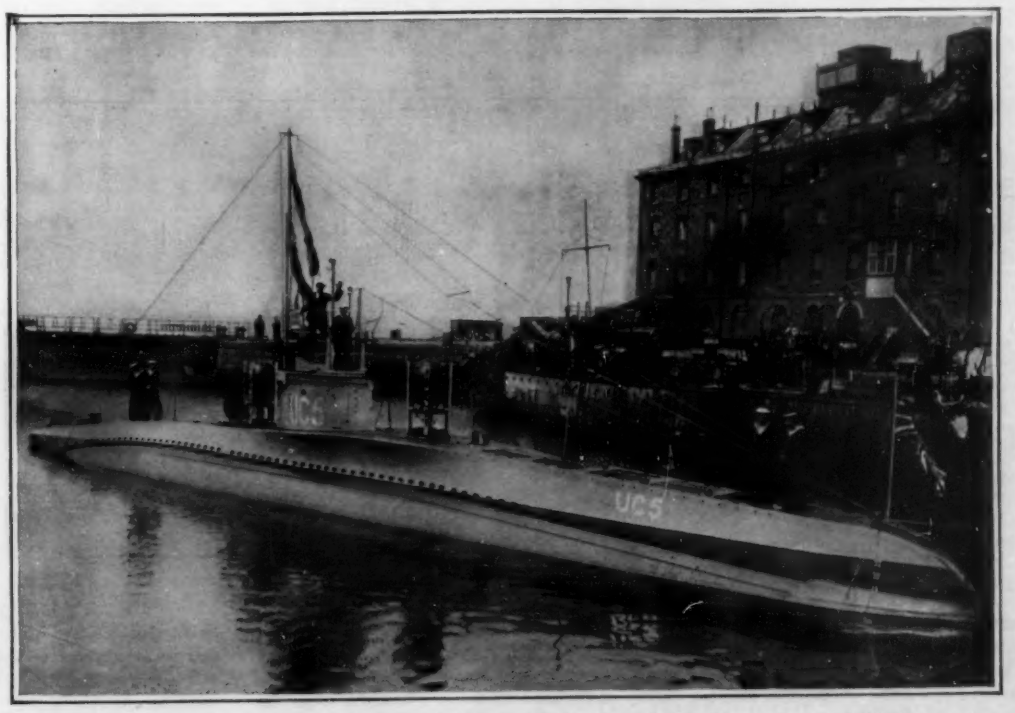
The mine-layer has every appearance of having been rapidly and somewhat roughly constructed. There is a lack of fairness in the lines and a want of finish in the plating and riveting, which would indicate that U-C 5 and her sisters are experimental boats. Except for the mishap to this captured boat, the little craft would seem to have been very successful in their mine-laying expeditions, and there can be no doubt that many of the losses of ships, in what were supposed to be mine-swept waters, were due to the secrecy with which the mine-laying can be done from a submarine.

In the case of the U-C 5, the mines are carried in a series of vertical, cylindrical wells, forward and aft of the conning tower. These wells extend from the top deck to the keel of the boat. They are a little larger than the diameter of the spherical mines, which are loaded into the wells, one above the other, each in its own cage, the cage consisting of a base and four uprights, hinged to the base. The bottom mine rests upon a hinged door in the bottom of the submarine. Below each mine is carried its anchor weight, and in the larger view this weight can be seen very clearly.

When the U-boat is at work, it proceeds, submerged, to the stretch of sea which is to be mined, opens the hinged doors in the bottom of the boat, and, by tripping a catch, releases the mines, each of which, with its weight, falls to the bottom. Here the cage opens, the four hinged uprights falling apart, releasing the mine. The spherical mine proper, being buoyant, rises, unwinding the anchorage cable between itself and the anchor weight. This unwinding continues until the mine has reached the desired depth, say 15 feet, below the surface, at which it is to float. This determination of depth is controlled by automatic mechanism attached to the mine.

The mine-layer is 110 feet long and its submerged displacement is 210 tons.

This shows one of the mines in its collapsible cradle on the deck of the submarine



The German mine-laying submarine, captured by the British. Length 110 feet; submerged displacement, 210 tons

Substitute for Rennet in Cheese Making

PERSONS interested in cheese making in the Province of Ontario, Canada, have been trying to solve the problem of the shortage of rennet. Before the war, calves' stomachs, which are used in the preparation of rennet, were obtained largely from European countries with which communication now is cut off. The Ontario Department of Agriculture is sending out circulars advising that the stomachs of all calves slaughtered in Ontario be saved, and that those who slaughter communicate with managers of cheese factories or representatives of the Department of Agriculture. The best results are obtained with rennet from the stomachs of calves that have been fed wholly on milk; other calves ought to have one or two feedings of milk before being killed.

Not only is home production of rennet being encouraged, but a substitute is sought. At the government model cheese factory and creamery of Finch, Ontario, experiments have been conducted in the hope of securing a substitute which will have the same effect as rennet. The experiments were conducted with pepsin. The government dairy inspector for the Cornwall district announced to the Cornwall Cheese Board on June 16th that the pepsin worked well, the scale pepsin giving better results than the powdered variety.

The pepsin can be dissolved as required in water at a temperature of 90 deg., although an expert at the Guelph Agricultural College recommends 110 deg. At the Finch, Ontario, factory, 4 ounces of pepsin were used to 1,000 pounds of milk. While in all the tests at Finch the rennet showed superiority over the pepsin, yet the difference was so slight as to be scarcely noticeable. The pepsin can be used alone or in conjunction with rennet. The former is reported to give almost as good results as the latter at about half the cost.

Vegetable Wax from Madagascar

INCREASING quantities of vegetable waxes are being used in the manufacture of candles, boots and furniture polishes, and phonograph records, the chief materials of this kind in common use being carnauba wax, Japan wax, and China wax; such products realize high prices and find a good demand. A product resembling carnauba wax is prepared in Madagascar from the leaves of the raffia palm, which is the source of the bass used by the gardeners. The wax is obtained from the residues of the leaves after the bass has been stripped off; it has approximately the same melting point (83 deg. C.) as carnauba wax, and behaves in the same way toward solvents. Provided that care is taken in its preparation to avoid inclusion of gritty impurities, the wax should prove useful to manufacturers of boot and furniture polishes.

New Methods of Utilizing Babul Pods for Tanning

BABUL pods, obtained from the tree that also produces the gum arabic of commerce, have long been known to contain a notable quantity of tannin (18 to 20 per cent). Owing to the fact that the tan liquor from the pods rapidly undergoes fermentation and thus deteriorates before the hides or skins immersed in it have become completely tanned, the use of this material has not hitherto been adopted by tanners. As the result of laboratory experiments conducted by the Department of Industries at Cawnpur, it is claimed that this obstacle to the utilization of the product can be removed. It is found that by the addition of a very small quantity (0.3 to 0.5 per cent of the weight of the pods) of crude carbolic acid to the infusion of the pods, fermentation is retarded to such an extent that the tan liquor can be used with satisfactory results. It has also been observed that the tendency of the tan liquor to ferment varies with its temperature. Below 60 deg. F. babul pods may be used with a very small addition of antiseptic or with none at all. As an alternative to carbolic acid, phenazole slightly acidified with acetic acid may be used.

The pods can be had in India for the cost of collecting them. From the Sudan, where they are known as garad (or sunt) pods, there is always a small export, which could be largely increased if a sufficient demand arose. The export value in the Sudan is about $34 per ton. The same product has also been occasionally exported from West Africa under the name of Gambia pods. Cheapness and abundance recommend babul pods to tanners.

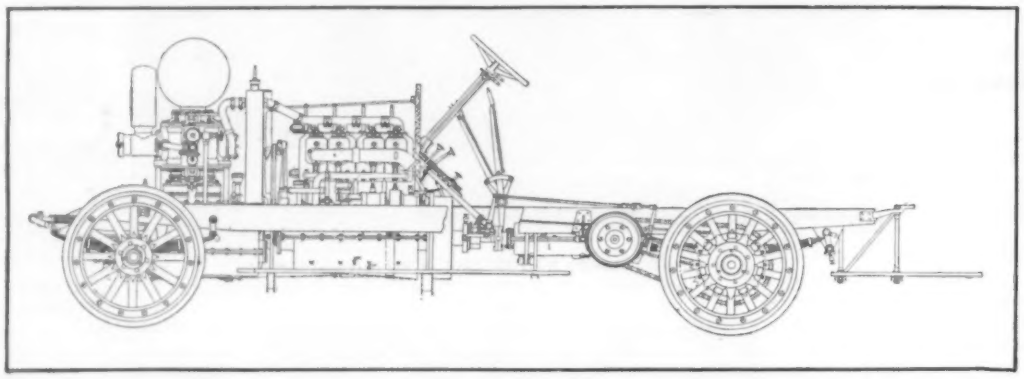
The Motor-driven Commercial Vehicle

Conducted by VICTOR W. PAGE, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles

Efficient Motor-Pumping Engine

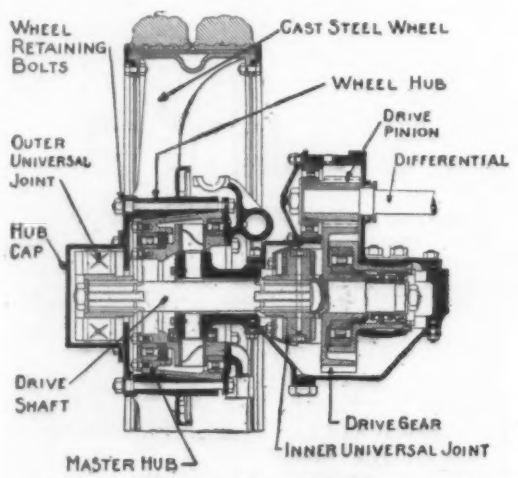
IN designing special purpose vehicles, a departure from conventional practice is often justified by securing advantages of value. In the gasoline pumping engine chassis illustrated, the pumping unit is placed forward of the motor and does not interfere with the disposition of the transmission system parts at the rear. The one gasoline engine serves to drive the car as well as furnish power for the pumps when the fire is reached. The clutches and transmission elements for road or pumping service are distinct, each set being independent and complete in itself. A slipping friction clutch in the road wheel drive system cannot affect the operation of the pump as is possible in forms of apparatus where one set of power elements serves both pump and road wheels. The placing of the pump at the front end facilitates placing the apparatus as the suction inlets are at the front while the discharge gates lead off at either side. All parts of the pump are as accessible as the power plant is. The engine is a four-cylinder type having a bore of 5¾ inches and a stroke of 7 inches. It is conservatively rated at 55 horse-power and will develop 80 horse-power on the brake. The pumping capacity of the multiplex piston pump is 700 gallons per minute. The chassis is fitted with a body carrying 1,250 feet standard fire hose, suction pipes, hand extinguishers, one 20 foot rapid extension ladder and one 12 foot roof ladder with folding hooks. The machine is capable of a speed of 35 miles per hour, and as it is provided with a three-speed selective gearbox, it will climb any grade ordinarily met with. The final drive is by side chains to the rear wheels. Two sets of brakes afford positive control. The wheel base is 156 inches, the tread is 56 inches. A 40 gallon chemical tank with necessary fittings may be installed in addition to the other equipment. A special feature of merit is the auxiliary cooling system to be used when the motor is running on continuous pumping service. Several coils of pipe project into the suction chamber of the pump and all the cold water drawn into the pump passes over their surface. The water from the radiator and engine water jacket by-passes through these coils and is cooled. The cooling effect may be regulated to suit conditions and in winter, the coils may be used as a heater to keep the pumps warm en route. This construction is made possible by the relative placing of pump and power plant. The same principles are carried out in a larger machine of 1,000 gallons capacity.



A novel motor-pumping engine

Combined Tractive and Directive Member

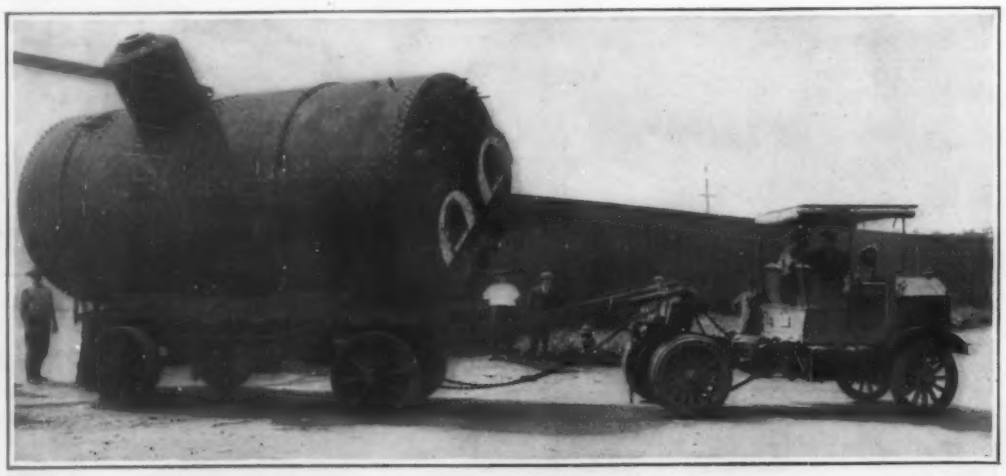
NUMEROUS designs have been presented for combining directive and tractive functions in motor truck wheels, especially in those types where front wheel driving is considered an advantage. The accompanying design is of English derivation and is intended to reduce the troubles resulting when power is transmitted through very short universally jointed shafts. It is an engineering fact that the tendency of a single universal joint is to produce a difference in the velocity ratio of the two members it connects except when these shafts are in line. It is also recognized that when two joints are employed the angular deviation and the attendant difference in ratio can be reduced. In the accompanying design the object is to have a front wheel hub housing a central wheel supporting pivot. One of the two universal joints is located within the hub cap, while the other is spaced the same distance from the center line of the spindle bolt toward the axle. A short shaft connects the two joints and is provided with splined ends to transmit the power. All sliding due to universal joint action when the wheel is displaced for steering takes place in the outer joint carried inside of the hub cap. Attention is directed to the quickly detachable feature of the road wheel which is held in place on a conical master hub by a series of bolts. The wheel is driven by spur gearing, the upper pinion being secured to one of the shafts extended from the differential gear located on the front axle. All of the radial bearings are of the short straight roll form while the thrust bearings utilize balls as load carrying elements. While a gear reduction is shown between the driving and driven shafts it is patent that this is not an essential part of the design as it is practical to attach the inner universal joint directly to the differential shaft.



Motor truck wheel with combined tractive and directive functions

Moving Boilers by Means of Motor Trucks

THE work of moving heavy objects has always been a fascinating one for those engaged in the task and the spectators. Large steam boilers are not easily handled, as a rule, but they are easily moved by the application of mechanical power as represented by the tractive or hauling ability of the modern motor truck. A large contracting company in Philadelphia recently received a contract to move a 33 ton boiler from a location in Holmesburg to the city power plant at Fairmount Park. After some figuring, it was found that it would take 28 horses to haul the load and ten extra animals with block tackle to start the load and for keeping it moving where highway conditions were not favorable. The special wagon upon which the boiler was mounted weighed 8 tons, making the total load to be moved 41 tons. A 60 horse-power gasoline tractor hauled this load to its destination without any trouble. Attention is directed to the pole hitch between the tractor and trailer, this giving better control because the tractor brakes could be used to retard the load as well as the shoe brakes mounted on the rear wheels of the trailing vehicle. The conventional type of motor truck has also been used for pulling a heavy boiler. The outfit shown in the accompanying illustration was used in Erie, Pa. The boiler weighed 20 tons without counting the weight of the special heavy gear used to support it. This load was hauled 7 miles, a feat that is somewhat remarkable as the truck was not loaded to obtain any increase in traction over that normally obtained.



A 60 horse-power tractor hauling a 41-ton load

Motor Truck Queries and Answers

G. M. G. writes: The attached clipping makes the statement that a car with a carrying capacity of 1,000 pounds can pull a trailer 4,000 pounds. This seems to me impossible over average country roads. I do not wish to bother you with unimportant questions, but as many farmers buy trucks instead of automobiles for the benefit they get out of the extra carrying capacity, it seems to me, if the above contention be true, that it would be better for them to buy passenger carrying cars and equip them with trailers. I trust that you may explain the matter in your columns.

Ans. An automobile built primarily to carry a load makes a very poor tractor for hauling trailers. Trailers have been used for load carrying in connection with pleasure cars, but these are only of 500 pounds to 1,000 pounds capacity and intended only for emergency or light work. The proportion given in the clipping is too high, as while this haul might be made on very good roads, it is evident that the automobile engine and transmission system would be worked to capacity which would impose injurious stresses on the chassis when pulling a load of any magnitude up a hill or on a sandy or muddy road. A trailer can often be used with good results if hauled by a truck but even this practice is not advised by truck makers. The amount of weight that can be hauled by any vehicle depends upon its drawbar pull. For the same amount of power a passenger-carrying car will not have the same drawbar pull as a truck. There is not enough weight on the rear wheels and the final drive gear ratio and resulting vehicle speed is too high to permit moving heavy loads efficiently. A truck is heavy and geared for slow speed, consequently the rear wheels have better traction and the drawbar pull is greater. A loaded trailer that could be hauled with ease by a pleasure car on a good road could not be moved at all in sand or mud. The conventional touring car is not intended to be used with a trailer and its continued use in this manner will result in rapid depreciation in the car mechanism. On asphalt or wood block paving a pull of but 12.25 pounds will move a wheel supported load of one ton. Nearly three times this pull is needed on a macadam road. In loose gravel 200 pounds pull will be required per ton load and 400 pounds in sand. These figures demonstrate conclusively that the pulling power depends upon the character of the road, to a large extent. In deep sand or mud, a touring car might not be able even to extricate itself.

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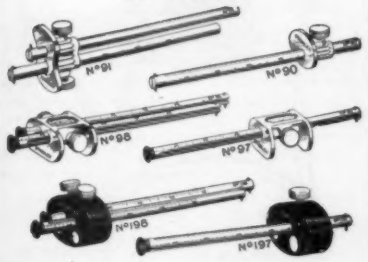

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A New Form of High Voltage Measuring Instrument

(*Continued from page* 167)

temperature. For this purpose a thermometer located inside the cylinder may be read through a window. The variation of temperature is only that of the atmosphere.

The essential parts of the Corona Voltmeter as described above are shown in the line drawing, while the lower illustration shows the instrument as built for the range 40,000 to 100,000 volts. This was the first experimental type and is unnecessarily large. The upper illustration shows the instrument as constructed for the range 20,000 to 50,000 volts. Referring to the drawing, A is the central conductor on which the corona forms. B is the outer grounded cylinder forming the opposite side of the high voltage circuit. Surrounding B which is perforated with a large number of small holes, is the cylindrical electrode C which is connected through insulated bushings to either the electroscope E or the galvanometer G. T is the telephone and P is the pressure and vacuum pump. The inner cylinder B and electrode C are inclosed in an outer cylinder which forms the air-tight casing of the whole instrument. The ends of this outer casing are of plate glass, which provides means for observing visually the first appearance of corona in case this should be desired. In the present forms the central conductor A which is of tool steel, nickel plated and carefully polished, is held in place by porcelain bushings cemented to the glass and disks. In the 50,000 volt instrument the central conductor is .396 cm in diameter. In the 100,000 volt instrument the central conductor is .635 cm diameter, and the surrounding cylinder 30.7 cm in diameter. As already stated, the range of pressure in each instrument is between 30 cm of mercury below and 60 cm above atmosphere with one central conductor.

Accurate measurement of high voltage is very desirable for the testing of the insulation of electrical machinery. The methods commonly in use depend on the voltage as measured on the low voltage side of the step-up transformer multiplied by the ratio of turns of the transformer. This method has been shown to be very uncertain. The Corona Voltmeter indicates directly the value of the voltage in the high tension circuit. In the case of alternating voltages the corona voltmeter indicates the maximum value of the voltage. The electric strength of insulating materials depends on the maximum value of the voltage.

The Corona Voltmeter is used in two ways. First, it may be set to indicate a given voltage, this being the method which would be adopted in the testing of insulation. Second, it may be used to determine the value of an unknown high voltage. In order to set the instrument for a particular value of voltage the temperature is read and for this temperature a calibration curve or table gives the value of pressure which is necessary in the tube for corona to form at the voltage desired. The pressure is then set at this value by means of the hand pump and the pressure gage. The testing voltage which is connected to the insulation to be tested and also to the Corona Voltmeter is then gradually raised until corona forms as indicated by either the electroscope, the galvanometer or the telephone.

In order to measure an unknown voltage the pressure in the Voltmeter is raised to a value known to correspond to a higher value of voltage than that to be measured. The pressure is then allowed to fall slowly by means of a small escape valve. As the pressure falls corona will appear at a definite value of pressure. The calibration curve or table will then give the required value of voltage.

The calibration curves or tables referred to may be obtained by comparing the reading of the Corona Voltmeter with those of any other standard such as the sphere-gap or standard potential transformers. The Corona Voltmeter, however, is very much more constant, reliable and

(*Concluded on page* 182)

"There's the Proof of the Postings"

Not until she had finished adding the postings and turned to read the total, did this Comptometer operator even glance at the machine.

Without raising her eyes from the book, she tapped in the figures, guided only by the sense of touch. She didn't have to carry the figures in mind a single instant—they went into the machine as she read them.

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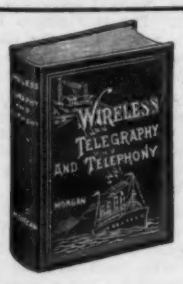

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RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

HAT MACHINE.—J. LAKE, JR., 405 East 4th St., New York, N. Y. This invention provides means for equalizing pressure applied to hat brims to accommodate the employment of a variety of shapes for molding said brims; provides a machine wherein pressures of different degrees may be applied to the shaping of the crown and to the brim of a hat; and provides means for applying a variety of pressures to different parts of a hat.

Electrical Devices

CONDUIT BOX ROSETTE FOR ELECTRIC WIRING.—A. BARTHELS, 161 Quincy St., San Francisco, Cal. This invention comprises a rosette having a reduced portion which projects through an opening in the conduit box cover and in this portion is a circumferential groove into which is fastened a split locking ring that engages the outer face of the cover while the annular flange formed on the internal portion of the rosette engages the rear face of the cover so as to hold the rosette securely on the cover, there being a key on the rosette which engages in a slot in the cover so as to prevent turning of the rosette.

Of Interest to Farmers

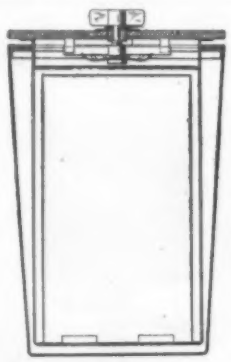
PLOWING DEVICE.—F. B. HULL, R. R. No. 3, Lyons, Kan. This apparatus dispenses with the use of the ordinary mold board plow and, at the same time, performs all the functions thereof, and includes a plurality of blades pivotally connected to a rotary element, such as a traction engine wheel, in such manner that said blades enter the ground in a substantially vertical position and effectively loosen the soil as the forward movement of the blade supporting elements progresses.

Of General Interest

DRAWER RACK.—F. BRADY, Middletown, Del. An object here is to provide partition members so connected as that they may be held in a series within a drawer and remain at all times freely removable and, when so removed, may be quickly and readily folded in compact form for transportation.

PROCESS OF MATCHING TOOTH CEMENT.—G. L. GRIER, and F. L. GRIER. Address The L. D. Caulk Co., Milford, Del. An object of this invention is the provision of a process for matching cement that is to be used as a filling for a tooth, with the tooth itself, so that after the cement is inserted it is very difficult, if not impossible, to distinguish the cement from the tooth itself.

DEVICE FOR WATERPROOFING CAMERAS.—W. S. STEARNS, Cambridge, Mass. This invention relates to a combined support and closure for cameras and the like, and more especially to an improved means for waterproofing folding cameras, to the end that such articles may be protected from dampness.



DEVICE FOR WATERPROOFING CAMERAS

Means provide for sealing the camera so effectively that it may even be dropped overboard, as from a canoe, without likelihood of injury from the water. For this reason the casing and its closure, which take the place of the usual leather camera case, are of especial value in touring, camping and the like. The invention comprises the combination of a camera with a combination supporting and closure plate therefor, the casing for the camera, and means to operatively hold the casing and closure plate in sealed relationship to protect the camera from moisture.

BILLING CARD.—L. W. GATCHELL, care of Yamhill Electric Co., Newberg, Ore. The object in this invention is the provision of a self-addressed billing card, such as used by light and power or companies using a monthly statement system, by the use of which an envelope for the bill is made unnecessary.

SMOKE CONSUMER AND FUEL ECONOMIZER.—H. S. AYLING, 36 Wisconsin St., Danville, Ill. By means of this invention the volatile carbon is consumed that is emitted from coal in combination with hydrogen as hydrocarbon gas. The amount of air admitted through the consumer meets the requirements of the amount of gas emitted from the coal. This is accomplished by the size of the pipes. The air is heated as near as possible to the igniting temperature of the gas. The air is admitted in such a manner as to be thoroughly mixed with gas while it is at a heat of incandescence in the flame, producing instant combustion. Almost complete combustion is obtained, so the heat of the fire-box is greatly increased, and this alone makes a much better steaming engine. There are also a number of combinations of coal that do not burn at ordinary fire-box temperature that will burn in the increased temperature. This effects a saving of fuel and prevents a great deal of the filling up of the fire-box. All the volatile carbon will be burned. All these things make a much better steaming engine, and the nozzle can be increased in size, thus again increasing the engine's efficiency.

Hardware and Tools

DRAFTING INSTRUMENT.—N. PAULSEN, 234-8th Ave., New York, N. Y. The instrument consists of a plurality of spaced parallel beams each having one or more adjustable marking devices for enabling parallel lines to be drawn, the parallel lines being adjustable longitudually of the beams for the proper spacing of the lines, and capable of being swung on their respective beams to one side or the other, so as to be out of the way when not needed.

BOTTLE OPENER.—R. FLITSCH, Leith, N. D. The main object here is to provide a device whereby corks may be extracted from bottles uninjured, which will not force a cork farther into the bottle by inserting the opener. The

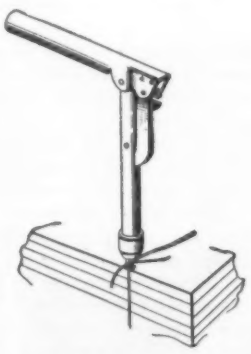
BOTTLE OPENER

invention forces the blades between the cork and the bottle, on diametrically opposite sides of the cork, and gives a spiral pull to the handle, thus rotating the cork within the bottle and moving the cork outwardly of the bottle at the same time.

MECHANIC'S TRESTLE.—F. L. GILLETT, 26 Church St., Montclair, N. J. The invention provides a trestle comprising two relatively movable side parts hinged together in a vertical central plane and adapted to be locked in gripping position as a result of the introduction of a board or other device between the jaw portion of said sides.

HEAT INSULATING COVER.—H. W. BURGHER, 551 Cherry St., Morristown, Pa. This inventor provides an insulating material in sheet form of uniform thickness; varies the thickness of an insulating cover by multiplying the number of unit layers employed; protects in service a cover constructed and arranged in accordance with his present invention; forms a cover having a cellular structure, and provides an insulating cover having internal dead air-containing chambers or cells.

WIRE APPLYING TOOL.—A. J. AMBROSE, address Cascade Lumber Co., North Yakima, Wash. The invention is an improvement in wire tiers and cutters, and it has for its object to provide a combination tool of the character specified, especially designed for facilitat-



WIRE APPLYING TOOL

ing the securing together of bundles of box-shook ends, wherein the tool is arranged to twist the ends of a piece of wire drawn around the bundle and to sever the piece from the remaining wire after the twist or knot has been formed.

Household Utilities

LIFTING DEVICE.—F. BUTLER, Box 466, Oxnard, Cal. This device is for use in lifting pans, plates, and other utensils and articles in camp, lifting milk pans or heavy articles such as nail kegs. The members are so arranged as to properly balance the load, there being a pair of hook members at one side and an opposed single member, and on the member having a pair of hooks a handle is provided, and on the single hook member, a lever being so formed, and arranged that the device may be manipulated with the digits of one hand for engaging and disengaging the hook members for the article to be lifted and for carrying the article level and with steadiness.

COUCH.—C. CARROLL, Box 502, Chicago, Ill. This improvement provides a device wherein a couch is so mounted and arranged that it may be used as a vibrator for the treatment of certain affections of the system, the couch comprising a body of the usual construction and a mounting for imparting a series of rapidly succeeding vibrations to the body.

TOOL FOR CLEANING TEETH.—J. ARRAT, San Pedro 12, Havana, Cuba. This improvement provides a handle and a series of brushes employed in conjunction therewith adapted for

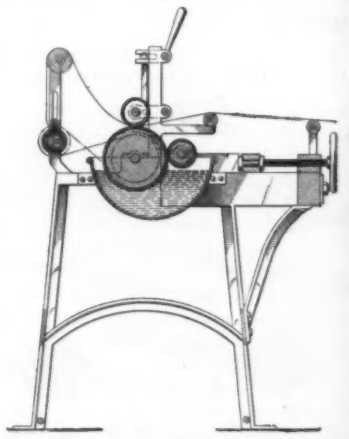
TOOL FOR CLEANING TEETH

special use in the operation of cleaning teeth; provides protective means constructed from vitreous material; and provides means for condensing the occupied space of a tool of the character described.

Machines and Mechanical Devices

CONCRETE MIXING MACHINE.—O. G. MANDT, Keokuk, Iowa. This improvement has reference to concrete mixing machines and has for an object the provision of an improved arrangement of mixing members fixed to the drum whereby there will be a quick and thorough mixture of material fed into the drum.

CLOTH AND SILK FINISHING MACHINE.—G. P. VUONO, 1120 Intervale Ave., Bronx, N. Y. This invention relates to finishing machines and particularly to a cloth and silk fin-



CLOTH AND SILK FINISHING MACHINE

ishing machine, and has for its object the provision of an improved mechanism whereby the finish of the material passed through the machine will be of the same quality throughout.

TROLLEY LADDER.—S. PUTNAM, care of Putnam & Co., 244 Water St., New York, N. Y. This invention provides means for normally holding a ladder of this type in stationary position; provides means for releasing the ladder to permit movement of the same to change the service location; and provides a simplified and inexpensive mechanism for controlling the movements of the ladder.

CHANGE SPEED GEARING.—P. HOLLENBECK, Kildare, Okla. This invention relates to transmission mechanism of various types of machinery, and has particular reference to gearing adapted especially for automobiles or other road vehicles. It provides a gear mechanism adapted for substantially a direct drive between the motor shaft and the driven axle at various speeds.

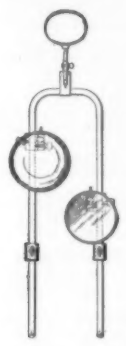
ANIMAL TRAP.—S. C. CAUSEY, 35 Linden St., Schenectady, N. Y. The invention has reference to animal traps, and more particularly to traps of that type including two compartments, one for enticing and entrapping the rat or other animal, and the other for killing the same, as by drowning. The animal after starting to enter the trap cannot withdraw and must proceed into the trap.

PLATEN CONTROLLING MECHANISM FOR PRINTING PRESSES.—J. E. RATHBUN, care of Rathbun & Bird, 8 Dutch St., Towaco, N. J. The invention times the movements of the type of the press bed and platen to permit feeding paper to the press while running

at a rapid rate of speed; steadies the position of the platen; avoids difficult and expensive repairs to the mechanism controlling the relative actions of the platen; provides means for adjusting the operating elements of the controlling mechanism; and provides a mechanism for accomplishing the above stated objects which may be applied on installed printing machines of conventional construction without dismembering said machines.

Medical Devices

LARYNGOSCOPE.—F. J. VERBA, Box 1087 Cragmor, Colorado Springs, Colo. This device is especially adapted for treating tubercular affections of the larynx by the direct application of sun rays to the diseased parts, and the device is so arranged and constructed that



LARYNGOSCOPE

the patient may treat himself by either reflection, that is, conveying the healing and anaesthetic infra-red rays into the larynx; or by refraction, that is, by conveying the germ destroying ultra-violet or actinic rays in the same manner.

AUTOMATIC EXPRESSION CONTROL FOR PLAYER-PIANOS.—M. S. HOWARD, Waukon, Iowa. This invention provides means for varying the force with which the individual notes of the piano are struck, and thus embodying to the maximum degree the accent, touch and expression, and the varying degrees of loudness utilized by a pianist in giving expression to a composition, by directly regulating the degree of vacuum attained in the individual striking pneumatics of the player mechanism.

SURGICAL INSTRUMENT.—H. K. FINLEY, Aspermont, Tex. The instrument is for use in the prevention and home treatment of women diseases, wherein injecting or inserting mechanism is provided in connection with a speculum capable of being expanded or opened or collapsed by the operator when the speculum has been introduced, and to the action of the medicament contained in the injecting mechanism, and wherein other mechanism is provided in connection with the expanding means for permitting the insertion of medicaments in liquid form.

APPLICATOR.—T. E. ROBERSON, Sheridan, Wyo. This device is especially designed for applying tampons of cotton or the like carrying a medicament in such manner that the tampon with a cord attached for permitting the same to be removed after it has served its purpose, may be easily and quickly inserted, and wherein mechanism is provided for permitting withdrawal of the applicator without disturbing the tampon through the sticking of the cord to the applicator.

Musical Devices

PIANO STRINGING.—W. G. SCHEINPFLUG, 15 Lott Ave., Woodhaven, L. I., N. Y. This invention relates to pianos and similar stringed musical instruments, and provides certain new and useful improvements in said instruments whereby the strings, especially those in the treble, remain in tune for a long period and when sounded produce flageolet tones or harmonics.

Prime Movers and Their Accessories

SPEED CONTROLLER.—J. G. ACEVES, care of Gillespie & O'Connor, 20 Vesey St., New York, N. Y. This controller is more especially designed for use on prime movers such as steam and gas engines, water wheels, turbines and the like, and arranged to cause the controlling devices of the prime mover to vary with a view to maintain the speed of the prime mover equal to that of a small pilot motor running at any desired speed.

VALVE SPRING RETAINER.—D. L. BROWN, care of Ardsley Towers, Irvington, N. Y. This inventor provides a retainer arranged to permit of conveniently disconnecting the spring from the valve to allow regrinding of the valve in its seat or removal thereof for repairs or other purposes, and to hold the spring confined in compressed condition for conveniently replacing it on the valve after the repairs have been made.

ROTARY VALVE FOR INTERNAL COMBUSTION ENGINES.—C. F. FOUNTAIN and W. A. LANGFORD, Address the former, Shawinigan Falls, P. Q., Canada. This invention provides a coreless rotary inlet and exhaust valve for an internal combustion engine of any of the usual types, which valve shall be of such a simple construction as to materially reduce the expense of constructing the engine by eliminating the usual cam shaft, valve lift rods, puppet valves, etc.

Railways and Their Accessories

STREET INDICATOR.—C. C. HAYS, 902 Atchison St., Trinidad, Colo. The invention relates more particularly to street indicators for electrical railway cars, the object being to promote automatic indication of each succeeding street along the line of travel of a car by simple and inexpensive means, which may be installed in a car and its automatic actuation provided for, with minimum change to the car and its apparatus as constituted before the invention.

MINE CAR WHEEL.—C. CLAUSEN, P. O. Box 597, Bisbee, Ariz. This invention improves the construction of wheels, whereby one wheel on an axle will be loose for permitting the two wheels to have differential movement for freely passing around a curve in the track, the wheel being provided with a bushing which is forced into the hub portion of the wheel and which freely rotates on the axle, there being a special formation whereby the bushing is engaged with a retaining ring fastened to the axle bearing, whereby the wheel can be removably applied to the axle.

AUTOMATIC TRAIN STOPPING AND RECORDING DEVICE.—F. F. HUDSON. Address David M. Crawford, Builders Exchange, Memphis, Tenn. This invention relates to improvements in automatic train stopping and recording devices. It provides means whereby a train may be automatically stopped when the engineer fails to regard the signals or by any other reason atempts to pass into a block into which a train has already entered.

ELECTRIC TRAIN STOP SYSTEM.—T. W. VICKERS, Ontario, Mont. This improvement relates to an electric block system which includes a trip device for each block, which is adapted to be set under emergency conditions to a position where it will cause the propelling power of the train to be interrupted and the brakes set so as to stop such train in order to prevent a collision or other accident.

Pertaining to Recreation

MARKER.—C. F. SCHIPPELL, care of Hawley & Hoops, 271 Mulberry St., New York, N. Y. This invention relates particularly to an arrangement for marking tennis courts or other places where a guiding line is desired, and provides an arrangement of vehicle and discharge members so that there will be a discharge of the marking material in proportion to the speed of the vehicle.

Pertaining to Vehicles

AUTOMOBILE GEAR.—J. R. S. SMITH, Box 11, Placerville, Colo. This inventor provides a driving gear by aid whereof the power may be divided equally and transmitted to different service wheels engaging the ground in such manner that when the vehicle is steered in different directions each service wheel receives substantially the same amount of power as any other service wheel, even though some of the service wheels be turned in steering to a greater extent than other service wheels located upon the different portions of the vehicle.

AUTOMATIC GEAR SHIFTING DEVICE.—F. A. BROWN and A. F. WAGNER, care of Wagner Specialty Co., 1902 Broadway, New York, N. Y. An object here is to provide an improved gear shifting device wherein when the power is turned on the starting device, the gears will be automatically shifted into engagement, and when the power is turned off said gears will be automatically disconnected.

REMOVABLE TOP FOR VEHICLES.—F. GRUNDY, care of Sterling Top & Equipment Co., 522 W. 57th St., New York, N. Y. This invention relates to the class of vehicles such as automobiles and the invention comprehends an improved top for automobiles by which a car having an open body can be converted into one of the limousine type particularly adapted for winter use or in cold and inclement weather.

PNEUMATIC TIRE SLEEVE OR PATCH.—R. YOST, Tyrone, N. Y. A specific object here is the provision of a form of fastener for interlocking with the sleeve, and so designed as to receive a lacing, there being a plurality of hooks or fasteners applied to the sleeve at each side thereof, whereby the lacing can be engaged with the hooks or fasteners alternately at opposite sides of the sleeve and wheel felly.

COMBINED WHEELED CARRIAGE AND SLED.—G. M. GOUDY. Address E. E. MUMMERT, Attorney, 110 N. Main St., Goshen, Ind. An object here is to provide a pair of runners or shoes for a wheeled carriage of any construction, to which is connected novel mechanism for lowering the runners for engagement with the ground when it is desired to employ the vehicle as a sled, and raising the same out of contact therewith when the wheels are used as the supporting medium.

Designs

DESIGN FOR AN AUTOMOBILE BODY.—D. F. OLIVER, care of Vanderbilt Hotel, 34th St. and 4th Ave., New York, N. Y. In this ornamental design for an automobile body, the invention provides outlines of novel and attractively graceful features.

DESIGN FOR A HOLY WATER FONT.—THOMAS LLOYD, Boston, Mass. This ornamental design for a font is shown in front and side elevations. The former comprises a representation of Christ on the Cross and surrounded by symbolic features.

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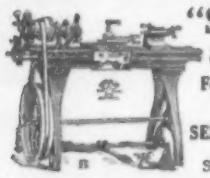

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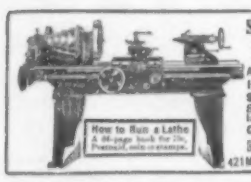

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(*Concluded from page* 179)

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German Official Story of the Skagerrak Sea Fight

(*Concluded from page* 173)

stage of the battle, bringing together the main fleets.

Vice-Admiral Scheer resolves to give battle to the English, although as is now known they are in full force and of more than double his strength.

Our battleship squadrons, with the armored cruisers at the head, make straight for the fogbank stretching across the northeast, from which such heavy fire has been directed upon the crippled "Weisbaden." Over a rapidly spreading area about this vessel there now spring up obstinate single combats. By reason of the increasing cloudiness, light enemy craft, supported by a squadron of five armored cruisers of the "Minotaur," "Achilles" and "Duke of Edinburgh" classes, which sallied in from the northeast as well as from the main hostile fleet, push forward in the direction of the "Wiesbaden" and are able to deliver concealed attacks upon our armored cruisers, and upon the leading division of our main line of battle. In this they are subjected to a galling fire, by which the small cruiser "Defence" and the armored cruiser "Black Prince" are sunk. The armored cruiser "Warrior" returns to her own line a wreck, to sink later. A small cruiser is severely used. Even before this two destroyers have fallen under the attack launched by our torpedo boats against the first battleships that hove in sight. A small cruiser and two destroyers suffer damage.

Our armored cruisers and the foremost of the battleship divisions of our main fleet are in this action and under the ever increasing fire of the enemy's battleship squadrons, which shortly after 8 o'clock swing noticeably out from the fog in a northeasterly, and later in an easterly, direction. At the height of the action, especially between 8:20 and 8:30, we note indications in the enemy line of the excellence of our gunnery. It is observed by several officers of our ships that a vessel of the "Queen Elizabeth" type vanishes into the air under circumstances very similar to those attending the disappearance of the "Queen Mary." The battle cruiser "Invincible" sinks, well hit below the water line. A ship of the "Iron Duke" class has been hit by a torpedo before this, one of the "Queen Elizabeth" class steams helplessly about in a circle, her steering gear apparently carried away. On our side the armored cruiser "Lützow," after at least 15 severe hits, is unable to maintain its place in the line. Vice-Admiral Hipper therefore transfers his flag under heavy fire in a torpedo boat to the "Moltke," the passing "Derfflinger" assuming direction of the fleet in the meantime. Part of our torpedo boats engage the main hostile fleet with good success. Here we lose a torpedo boat after repeated hits; and a hostile destroyer is seen sinking after being struck by a torpedo.

After this first heavy blow at the preponderant forces of the enemy, the contestants are lost to each other's sight in clouds of smoke and powder. But when the gunfire is checked for a space in consequence of this the commander of the fleet rallies all his available forces to another onset. Our armored cruisers, which with a few small cruisers and torpedo boats are again at the head of the line, shortly after nine o'clock strike back against a renewed heavy fire from the veil of fog, returning this handsomely with the aid of the foremost divisions of the main fleet. Running at top speed, the armored cruisers now hurl themselves with reckless valor into the task of bringing the torpedo boats within reach of the hostile line; and in the teeth of a raking fire they approach to within 600 meters. Several of our torpedo flotilla rush to the attack, deliver their blows, and in spite of the most violent opposition, turn back with loss of only one boat. After this second powerful stroke the battle wanes amid dense billows of smoke from guns and stacks alike. Following the next onslaught, several torpedo boats find, upon piercing the cloud of smoke, that the main enemy squadron is not there. Nor when the commander of the fleet sends our forces off on the southerly and southwesterly courses, upon which the foe was last seen, is there any trace of him.

Once more, just before 10:30, the battle lives again for a short time in the late twilight. Off to the southward our armored cruisers sight four hostile battleships, upon which they at once open fire. As two of our battleship squadrons join in the enemy turns and disappears in the darkness. Our oldest small cruisers of the fourth scouting group are in a brief action against some old enemy armored cruisers, and with this the day of fighting is ended.

After the disappearance of the enemy, when our ships take up their night march to the southward, they are closely followed till dawn by hostile small vessels, whose lesson is made a light one by the general strategic plan and by the extreme darkness of the night. During a meeting between our fourth scouting group and a superior force of miscellaneous cruisers, which escape under heavy fire, the small cruiser "Frauenlob" is badly damaged, lost to sight, and seen no more. An armored cruiser of the "Cressy" class comes suddenly into view close to our battleship line, is afire under our cannonading within forty seconds, and after four minutes sinks. The destroyer "G 60"—the number is seen but indistinctly in the night, and is therefore not certain—the destroyers "G 3," "78," "G 06," and "27" are sunk by our precautionary fire within a space of seconds. Another destroyer is rammed and cut in two by one of our battleships, and in addition seven destroyers, among them the "G 30," are met and badly damaged. Others, among them the "Tipperary" and the "Turbulent," which had been abandoned in sinking condition after the rescue of the surviving members of their crews, drift past our lines, some of them burning fiercely. Countless torpedo wakes are observed from our ships; but only the "Pommern" falls victim to an unquestionable torpedo blow. The small cruiser "Rostock" is hit, but remains afloat. The small cruiser "Elbing" is damaged by one of our battleships in an unavoidable collision in the course of a maneuver. After futile efforts to keep her above the water she is at length allowed to sink after the crew has been transferred, to the last man. Finally, we lose a torpedo boat which runs upon a mine laid by the enemy.

The losses through the efforts of the enemy, which in sea fighting alone afford a measure of efficiency and inefficiency, are here summarized (the English losses are according to the most careful estimates):

	English.	German.
Battleships of the first line	1	0
Large armored cruisers	3	1
Older battleships	0	1
Small cruisers, etc	3	3
Destroyers and torpedoes	12	5

*In addition the "Elbing," through accident.

Of these the "Lützow" and the "Rostock" did not sink till after the battle.

It should be finally noted that aside from those here given, the German fleet has lost no ship of any sort, either during the battle or during the return to the base.

Against a strength ratio of 2:1, the ratio of losses was: large ships, 4:1; smaller ships, 2 or 3:1.

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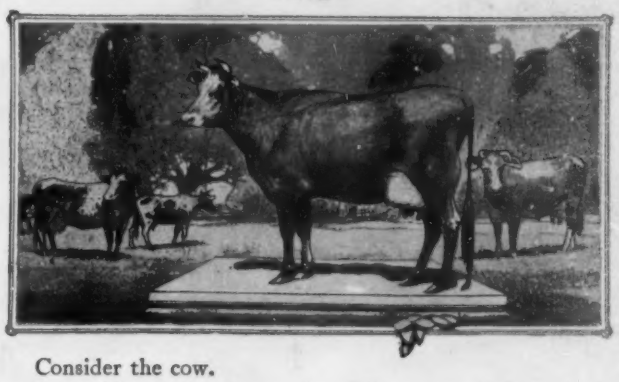

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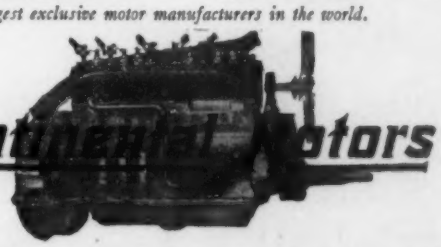

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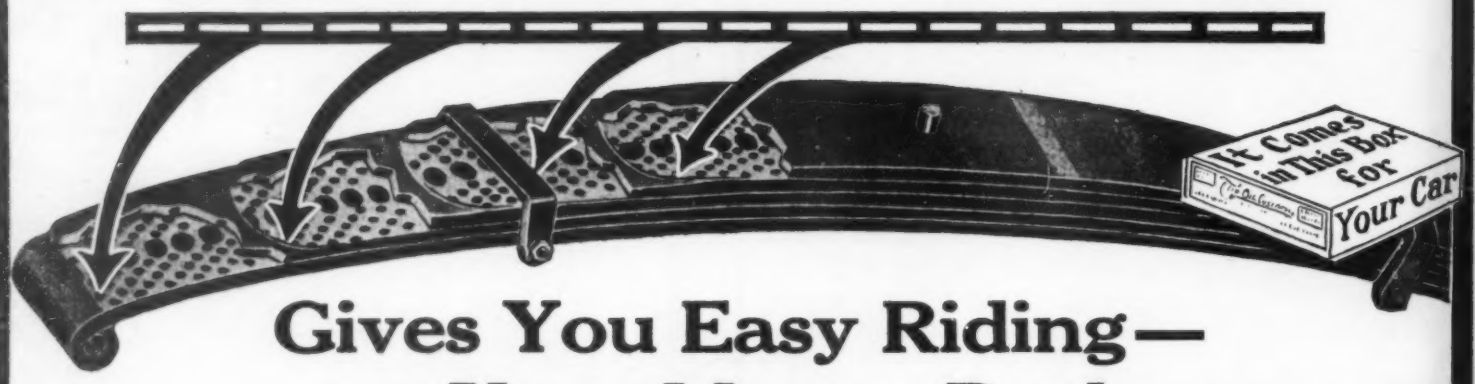

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